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FOREIGN MILITARY REVIEW

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Regional Conflicts: Origins and Solutions

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[Article by Maj Gen (Res) Ye. Dolgopolov, candidate of philosophical sciences]

[Text] Political settlement of regional conflicts occupies an important place among the most pressing problems of the modern military and political situation, raised to the forefront in light of the new way of political thinking in international relations established by the 27th CPSU Congress.

The idea of creating a nuclear-free and secure world is based on rejection of war as a means of resolving disputes, and recognizing the right of every nation to freely choose the paths of its socioeconomic development. This is precisely why the CPSU, which made the struggle against nuclear danger and the arms race and for preservation and reinforcement of universal peace the main direction of its activities in the world arena, emphasized the need for activating a collective search for ways to untangle conflict situations in the Near and Middle East, in Central America, in South Africa and in all of the planet's "hot spots."

Given the unconditional priority of the struggle to eliminate world nuclear missile war, that these problems are interrelated is entirely obvious. Nuclear confrontation in the world arena and initiation of regional military conflicts are two sides of the imperialist policy of military power, the nature of which has not changed; nor has its desire for social revenge.

In the military-political area, reliance upon nuclear confrontation, which poisons the international atmosphere on a world scale, not only does not reduce but on the contrary increases the danger of regional conflicts. In turn, these conflicts, which create tension at a local or regional level, have a significant effect on the general state of international relations.

Soviet-American summit meetings, which have demonstrated the fundamental possibility of traveling the road of gradual elimination of nuclear missile arsenals, are doubtlessly creating more-favorable conditions for settlement of conflict situations. It was precisely in this period that the Geneva agreements on Afghanistan were signed. In terms of their significance they are of the same rank with the Soviet-American Intermediate-Range and Shorter-Range Missile Treaty. It was emphasized in the Joint Declaration signed following the Moscow Soviet-American summit talks that "although serious differences were revealed as a result of the talks in assessments of both the causes of regional tension and the means of surmounting it, the leaders agreed that these differences must not serve as an obstacle to constructive interaction between the USSR and the USA."

At the same time, while quite recently some people in the West were trying to make implementation of disarmament measures dependent upon resolution of regional conflicts, now attempts are being undertaken to capitalize on their prolongation, and perhaps even their aggravation, as a unique sort of "compensation" for the impending elimination of intermediate-range and shorter-range missiles. The impression is created that the USA needs regional conflicts as a constant reserve for maneuvering the level of confrontation, for power politics and for anti- Soviet propaganda.

This is precisely what is implied in some recent statements by highly placed representatives of the American administration who were seasoned in the spirit of the old way of political thinking and cold war—statements confirming adherence to Washington's policy of interference in regional conflicts under the excuse of "protecting liberty and democracy" and rendering assistance to so-called "freedom fighters."

We cannot forget that in these times, in which the interdependence of states has risen immeasurably, any armed collision at any point on the globe, even one which might appear to be minor at first glance, may sharply aggravate the international situation and become a potentially dangerous focus of a global military conflict. It is well known that insignificant incidents, including ones provoked by the aggressor, served as the immediate grounds for beginning the first and second world wars. And although the situation and the correlation of forces in the world arena have changed fundamentally, this historical experience cannot be left unheeded.

The fact that there have been over 200 local wars and conflicts after 1945, as a result of which more than 20 million persons perished—twice the total losses of World War I, is evidence of the danger which regional conflicts bear. Troops of approximately two dozen countries were directly involved in major wars of this period such as the aggression of the USA and its allies in Korea (1950-1953) and in Southeast Asia (1965-1975). In this case the most militant American circles called for the use of atomic weapons against Korean and Vietnamese patriots. Some conflicts of this period—for example the Suez crisis of 1956 or the Caribbean crisis of 1962—brought the world close to its flash point. The presently developing crises in the Near and Middle East, in Central America, in South Africa and in other regions are also extremely dangerous. The boundaries of the conflicts are expanding dangerously, and the circle of states having interests affected by these conflicts is growing. In other words unless the necessary measures are taken promptly, each of these conflicts has a tendency toward increasingly greater expansion. If we add to this that Israel, South Africa,

Pakistan, Taiwan and some other countries are close to becoming members of the nuclear club, the danger of regional conflicts rises even more.

All of this predetermines the great significance of the problem of regional conflicts within the overall complex of international relations and in implementation of the program proposed by the Soviet Union for creating a universal system of international security.

When we look at their content, we find that regional conflicts are a regional manifestation of political, economic and ideological contradictions between countries (groups of countries). As a rule they presently reflect the duel between the forces of imperialism and reaction on one hand and the forces of national liberation and social progress on the other.

Regional conflicts are expressed both in open armed collisions, including on a large scale (the Iran-Iraq War for example) and as the presence of centers of military tension (the Near East conflict). In regional conflicts, military problems intertwine with political, economic and humanitarian problems. Unleashing regional conflicts, reactionary imperialist circles try to use the force of arms to deprive the people of the right of choosing the path of their own development, exert economic pressure and impose sanctions, stir up racial, national and religious discrimination, and so on. Regional conflicts, M. S. Gorbachev notes, "are bleeding wounds capable of giving birth to spots of gangrene on the body of mankind.... Who gains from these conflicts? No one besides the arms merchants and various sorts of reactionary, expansionistic circles that have become accustomed to warming their hands and profiting on the people's misfortunes and woes."

As a rule, regional conflicts are lengthy, protracted in nature: For example the Near East conflict, which centers about the Palestinian problem, has now been going on for over 40 years.[1] Since the early 1960s the conflict in South Africa, which has an even longer history, sharpened dramatically. At first the racist regime initiated military actions against the indigenous population of South Africa, and then against the people of Namibia, which was occupied illegally by racists. In recent years they have been inspired by the undeclared wars against Angola, Mozambique, Zimbabwe and other states situated near the area of conflict.

The conflict situation in Central America has grown sharper since the late 1970s, as is evidenced by the undeclared war against Nicaragua, by the civil wars in El Salvador and to a lesser degree in Guatemala, and by transformation of Honduras into a springboard of imperialist aggression in the region. Conflicts in Afghanistan and Kampuchea resulting from foreign imperialistic interference have been going on since this time as well. The war between Iran and Iraq has been going on since 1980, and its unfavorable influence on the situation in the region is being intensified as a result of unprecedented concentration of the naval forces of the USA and other NATO countries in the Persian Gulf. Military tension has persisted for many long years on the Korean peninsula.

Some conflicts, for example in Chad, which arose in their time as purely domestic conflicts, acquired not only a protracted but also an increasingly expanding nature as a result of interference from without and attempts to turn their focus against neighboring countries pursuing an independent course (against Libya in our example). The problem of the Western Sahara affects the interests of Algeria, Mauritania, Morocco and other countries of the region. The situation on Cyprus is concerned with mutual relationships not only between Greece and Turkey but also many countries of the eastern Mediterranean. There are even more "elderly" conflicts, such as in Ulster for example, which arose in response to division of Ireland in 1921. It is fully understandable that any armed conflict, including an internal one, is capable of poisoning the atmosphere in an entire region, and of creating a situation of anxiety and alarm for neighbors, not to mention the sufferings and losses of the people of the country itself.

Every regional conflict has its roots, its history of development, resulting from a unique combination of political, national, religious and other features of the corresponding countries and regions. Although regional conflicts differ in their nature and in the nature of the opposing forces, as a rule they arise on a local foundation and as a consequence of internal or regional contradictions brought into being either by a colonial past, or by new social processes, or by the vestiges of predatory policy, or by all of the above taken together. To suggest that these centers of conflict are the product of rivalry between the East and West is not only incorrect but also extremely dangerous. Suggestions by bourgeois ideologists that the "hand of Moscow" is supposedly operating here, and equally so the desire to represent these conflicts as a manifestation of "international terrorism," which is a label attached to the national liberation movement, are all attempts to conceal the true causes of regional conflicts.

If we were to approach the causes in historical retrospect, we would have to note that the colonial system, during the existence of which many regional conflicts came into being, evolved as a result of continual predatory wars, punitive expeditions, acts of piracy and the slave trade. Just one of the oldest colonial powers—Great Britain—fought a sum total of 230 wars in 400 years, directed at seizing colonies and enslaving nations. In 2 centuries the USA initiated over 200 aggressive wars and colonial campaigns. Other former colonial powers are also credited with many of them.

As a result by the beginning of the 20th century the entire world was in reality divided between the major imperialist states. Besides colonies, a typical example of which

might be India, there existed different forms of semicolonial dependence—China, Iran, Turkey, Afghanistan, Egypt, some countries of Latin America and others. All of these visible and "invisible" colonial empires essentially relied on direct armed violence.

The struggle between imperialist states to redraw the already redrawn map of the world was one of the main causes of both the first and second world wars. Nor can we treat as being accidental the circumstance that during the disintegration and subsequent fall of the colonial system in the time following World War II the people of approximately half of the countries that achieved political independence were compelled to achieve it through armed conflict with imperialist oppressors and their accomplices.

These days, in which the colonial system in its classical forms has practically collapsed, in many ways capitalism has managed to salvage the previously evolved relations of economic dependence through political maneuvering, promises and bribery, military threats and blackmail, and often even direct interference in the internal affairs of liberated countries. On this basis imperialism was able to create and perfect a most sophisticated system of neocolonial exploitation, and to tie a significant number of liberated countries closer to itself.

As a result the gap between the small number of developed capitalist states and dozens of countries in Asia, Africa and Latin America is growing increasingly larger. Their financial indebtedness has attained catastrophic dimensions ($1.2 trillion in 1987); this is nothing more than a consequence of the egoistic, truly piratic activities of banks and corporations of the capitalist world.

Especially indicative in this regard is the presence of an unconditional causal relationship between the enormous foreign debt of liberated countries and the more than trillion dollar increase in the USA's military expenditures in the last decade. Also typical is the coincidence that the profits extracted each year from developing states just by American monopolies alone (over $200 billion in 1986) make up the lion's share of the USA's military budget in recent years.

Therefore it is no accident that whenever nations wish to exercise their legal right to strengthen their economic independence and take control over their own resources, imperialist states, and chiefly the USA, meet these attempts with military force and other subversive resources. This is the way imperialist circles behaved back in the first postwar decade, when nationalization of Iran's petroleum industry served as the grounds for the overthrow of the legal Iranian government in 1953 under the CIA's leadership, and when Egypt's nationalization of the Suez Canal served as the grounds for Anglo-Franco-Israeli aggression in 1956. This is the way neocolonialists are behaving today as well, attempting to keep control over liberated countries.

In this case imperialist circles are striving to profit from all contradictions and complications arising in relations between liberated countries, and from internal discord and internecine warfare. In south Asia, for example, the USA has long been speculating on the conflicts between Pakistan and India, which goes a long way to explain the armed conflicts between these countries in 1947-1949, 1965 and 1971. Instigation by imperialist circles played a major role in the advent of the Somali-Ethiopian military conflict of 1977-1978. Conflicts between the Greek and Turkish communities of Cyprus are being deliberately fanned, resulting in division of the island. Religious conflicts are growing in Lebanon, and Israel is capitalizing on them for armed interference into the internal affairs of this Arab state.

All crisis phenomena, tension and confrontations are associated to a significant degree with the fact that imperialist states are attempting to solve their problems on the basis of the stereotypes of the former way of political thinking, from imperialist positions, according to which it was felt to be "legal" to exploit other nations, to dispose of their resources and to decide their destiny arbitrarily. This is precisely what explains the view of the world, still existing in the West, as one's own private domain; this is what explains the arbitrary proclamation that many regions of the world are the zone of one's "vital interests."

The 27th CPSU Congress emphasized the close relationship between militarism and neocolonialism, noting that militarism is directly interested in preserving and increasing the brutality of the system of neocolonial super-exploitation. It can be said with full grounds that militarization of and nonequivalent exchange with the developing world are two especially dangerous manifestations of the laws of capitalism.

The doctrine of "neoglobalism" adopted by the United States is the most general expression of the policy of modern colonialism and militarism. Its material foundation consists of transnational corporations—a mechanism through which developed capitalist countries pump out the national wealth and the natural resources of developing states. The armed forces and special services of Western countries attempting to penetrate into all of the remote corners of the planet are standing guard over these neocolonial empires.

However, use of military force, upon which the USA rests its hopes, in order to maintain the status quo, to protect the interests of monopolies and of the military-industrial complex and to halt progressive transformations in liberated countries only complicates the situation and generates new conflicts. Increased exploitation of liberated countries by imperialist monopolies naturally causes growth of the resistance of nations to the imperialist policy of plunder and robbery.

The new wave of liberation presently gathering force in the zone of national liberation carries the threat of far-reaching consequences unless the developing countries receive a position of equality in international economic relations. "The world," said M. S. Gorbachev, "is interconnected and interdependent not only because nuclear catastrophe will spare no one. The risk associated with the fact that the poles of wealth and poverty are growing ever farther apart is increasing with every year. Solution of this problem is one of the grand tasks of protecting the modern world from destruction."

Taking the side of nations struggling for their national liberation and independent economic development, and providing them all possible assistance, the Soviet Union and other fraternal socialist countries are decisively supporting the search for political solutions to problems in this zone of the world. This is precisely the basis for the decisive position taken by the 27th CPSU Congress in regard to settling conflict situations—a position that has received wide international recognition and support.

The policy of national reconciliation, which was proclaimed in Afghanistan (January 1987), in Kampuchea (August 1987) and in Central America (August 1987), where Nicaragua occupies the most consistent position in the matter of implementing the agreements that have been reached, has become a manifestation of such a constructive approach.

The policy of national reconciliation rests upon the recognition that military solution of existing conflicts is unpromising. The essence of this policy is that parties in conflict may promote solution of general national problems not by means of armed conflict but by participation in political dialogue, without any kind of interference from without. The policy of national reconciliation promotes consolidation of all truly patriotic forces, and it causes division of reactionary groupings and isolation of extremist circles, which essentially find the meaning of their existence in totally unjustified armed violence.

The Soviet Union is making a major contribution to political settlement of the situation in Afghanistan, having adopted a political decision back during the 27th CPSU Congress to withdraw the limited contingent of its troops from this country. The deciding factor leading to the signing of Geneva agreements on Afghanistan was the declarations of Soviet and Afghan leaders on 8 February 1988, and their meeting in Tashkent on 7 April moved the process of signing the agreements to its concluding stage. Withdrawal of Soviet troops from Afghanistan was started on 15 May, and it will end not later than 15 February 1989. The CPSU Central Committee warmly welcomed the Soviet soldier- internationalists who honorably and courageously fulfilled their military duty and displayed high feelings of internationalism in their deeds. As is noted in the joint Soviet-Afghan declaration, cessation of foreign interference in the country's internal affairs remains a core problem of settling the Afghanistan situation.

Positive resolution of the situation in Kampuchea is being promoted by the constructive position of Vietnam, which has been withdrawing its voluntary troops from there stage by stage since 1982; the withdrawal is to be completed by 1990. As far as military assistance to Nicaragua from the USSR is concerned, this issue must be examined in the general context of mutual cessation of arms deliveries to the Central American region.

Other examples showing that the idea of peaceful settlement of regional conflicts is paving its way increasingly more aggressively can also be cited. Included among them are the constructive initiatives of Angola and Cuba directed at settling the conflict in southwestern Africa as quickly as possible on the basis of the independence of Namibia and the security of Angola. It is indicative that within the country the Angolan government is pursuing a policy of peace and national harmony, which is one of the variants of the policy of national reconciliation.

Such is the course of the Korean Peoples Democratic Republic, directed at weakening tension on the Korean peninsula and creating the groundwork for political resolution of the problems existing there and for peaceful democratic unification of the country on the condition that American troops and nuclear weapons are withdrawn from South Korea. North Korea's appeal for dialogue is reinforced by practical steps to improve the situation, including reducing the strength of the Korean Peoples Army by 100,000 men.

The signing of an agreement between India and Sri Lanka settling a long- lasting ethnic conflict on the island, signed in July 1987, may be viewed as a reflection of this same trend. In this case both sides demonstrated a realistic approach to breaking the logjam of the conflict situation by political means in the spirit of the new way of political thinking, and on the basis of reasonable compromises.

On the whole, the situation presently evolving favors peaceful settlement of crises. Also operating here are factors of an internal order—on the part of those who are directly involved in these crises, and factors of a general order—the positions that assume dominance in the world community. At the same time we cannot but be anxious in regard to the insistent attempts by militaristic circles of the USA and its allies to essentially torpedo the positive processes that have just begun, and to clutter possible agreements with clearly obstructive conditions and qualifications which actually castrate the very idea of national reconciliation.

The tendency discernible in the practice of international relations to settle conflict situations, including armed conflicts, by political means could have become dominant, had imperialist circles of the West not created constant obstacles on this path. The American administration's clearly visible intention to continue to provide military assistance to armed opposition groups fighting

against legal governments—such as in Afghanistan, Nicaragua and a number of other countries—is a special danger. This is all the more intolerable because many groups either reject outright the agreements that have been reached, or do everything they can to maintain the existing tension in one way or another. Clearly this is not the path which could lead to peace as the most important prerequisite of fulfilling the constructive tasks facing these countries. It is impossible not to see that those who assume positions of confrontation and try to heat up existing conflicts are actually pouring oil on the fire, which could only lead to further aggravation of the situation.

The facts show that the policy of imperialist states headed by the USA in relation to the developing world is one of neocolonialism in goals and one of state terrorism in methods. As before, the principal emphasis is laid on the pressure of military force. The following can be distinguished among the most widespread techniques used to initiate regional conflicts:

—direct armed actions against liberated states—the aggression in Lebanon (1982), occupation of Grenada (1983), military provocations against Libya (1986), the Falkland crisis (1982), interference of the USA and France in the internal conflict in Chad, and demonstrations of force in relation to Nicaragua and Panama, and in the Persian Gulf;

—arming, training and financing mercenary armed formations fighting undeclared wars against Angola, Afghanistan, Kampuchea, Mozambique, Nicaragua and other countries;

—rendering assistance to subcontractors of imperialism such as Israel, which is carrying on "creeping annexation" of indigenous Arab lands and which has initiated bloody terror against the Palestinians, or the Republic of South Africa, which is ruthlessly suppressing not only the indigenous population of its country but also Namibia, illegally occupied by it, and which initiated aggression against Angola and is carrying out subversive actions against opposing states;

—encouraging military fascist regimes such as Chile and Paraguay, and supporting separatist forces and movements in India, Sri Lanka, and earlier in Nigeria;

—using reactionary militarists to oppose positive shifts in the life of liberated countries (the Philippines).

Increasingly greater attention is being devoted in the policy of "neoglobalism" to preparing the U.S. Armed Forces for participation in low intensity conflicts. These are defined as various forms of armed violence which, in the minds of American strategists, should not develop into "limited" war, as well as demonstrations of force, support of subversive elements and so on. Typically the report on the USA's long- range strategy, drawn up by a special commission for participation in low intensity conflicts, proposes allocating 4 percent of the gross national product annually or a one-time sum of $12 billion, which would mean an increase in assistance to so-called "freedom fighters." As far as the USA's special services are concerned, B. Woodward's book "The Shroud: The CIA's Secret Wars, 1981-1987," published in 1987, notes that this espionage agency has transformed into "a state within a state," and that it widely utilizes insidious methods such as conspiracies, diversions, assassinations and secret wars.

Besides the pressure of military force, imperialism widely employs the methods of imposing separate deals and dividing national liberation forces. Thus in its time the USA conducted its dealings in the Near East, where in 1979 it was able to get Egypt and Israel to sign a separate "peace" treaty, which isolated Egypt from the common front of Arab states opposing Israeli aggression. In 1983 a "peace treaty" with Israel was imposed upon Lebanon with the assistance of the United States. It limited the country's sovereignty and violated its territorial integrity, and it was only under pressure from Lebanese national patriotic forces that it was annulled in 1984. Today Washington would like to divert the process of finding ways to achieve a settlement in the Near East into the rut of separate deals, far afield of the goals of establishing firm peace in the region. The accent is being placed on intermediate measures and steps which leave a total settlement that would include creation of an independent Palestinian state in the dark. It is entirely obvious that the most effective mechanism of settlement would be an empowered international conference in which representatives of all parties to the conflict would take part, including the Arab people of Palestine, and permanent members of the U.N. Security Council.

The USA and other NATO countries are using similar tactics in Namibia, which is illegally occupied by South African racists. An armed struggle for liberty is being fought there under the leadership of the Peoples Organization of Southwest Africa. In opposition to U.N. decisions, racist rulers are attempting to implement a so-called "internal settlement" taking the form of deals with its puppets, and thus establishing a neocolonial system of rule. The so-called "contact group" (USA, England, France prior to 1983, FRG, Canada), which was created in 1977 and which is actually covering the maneuvers of the racists, is playing a negative role in this case. It is also known that attempts are being made to "tie" Namibia's independence to an issue having absolutely no relationship to this process—withdrawal from Angola Cuba's internationalist forces, which are in the country at the request of the legal government for its protection against aggression from without.

Racists tried to use similar tactics earlier in Southern Rhodesia (today's Zimbabwe), where "independence" was proclaimed illegally, one- sidedly in 1965, and where a neocolonial agreement on "internal settlement" was signed with the participation of puppet African officials in the face of the armed struggle of patriotic forces in

1978. Only a wide armed struggle by the popular masses led to proclamation of true independence for Zimbabwe in 1980; in this case the opposing sides were able to settle the conflict by political means in the concluding stage.

As far as the Republic of South Africa, the principal bastion of racism in southern Africa, is concerned, the racist regime presently in power is attempting to undermine the armed struggle of liberation of the indigenous population led by South Africa's African National Congress by utilizing the tactics of creating puppet Bantustan states that are represented as being "independent" but which are in fact reservations of sorts for the indigenous African population.

Other neocolonial methods of resolving conflict situations are also being attempted—for example the Anglo-Irish agreement of 1985 on Northern Ireland, which not only fails to foresee real settlement of the Ulster crisis but which secures the power of British imperialism over Irish soil even more. The development of events following the signing of this agreement shows that the political situation in Ulster continues to grow worse.

The process of violent transformation of a protectorate of the United States—Micronesia—into its neocolonial possession has been going on for more than four decades. In violation of international law and despite the resistance of the local population, which has often led to tumultuous confrontations, Washington divided this territory into several tiny states, upon which "special relations" with the USA were imposed in the form of "associations" or "communities." A somewhat similar thing occurred in New Caledonia, where France, circumventing U.N. resolutions and ignoring the will of the indigenous population, the struggle of which has become especially acute in recent years, managed to legalize its neocolonial presence. The only result of such approaches is that the disease is forced deep inside, to threaten new complications. We were reminded of this once again by the recent armed confrontations between participants of the movement for independence of New Caledonia and French police.

The experience of recent decades reveals the entire perniciousness and hopelessness of attempts to resolve conflicts by armed means. It shows that the sole correct approach is to search for political solutions. In other words, to create an international legal situation about a center of conflict which would first of all prevent the addition of "fuel" from without, secondly guarantee that this center would not expand to other countries and regions, and thirdly ensure that the people themselves, and only they, would make the sociopolitical choice without foreign interference.

In this case such a choice should not become the grounds for events or tendencies in international relations which might expand into conflicts or a military confrontation. The development of the military-political situation in the world arena persuasively shows that conflict situations can be resolved in various regions only by emphasizing modern realities and the will of the people, by combining principles and steadfastness with flexibility and a willingness for reasonable compromise. This is one of the facets of the dialectics of the struggle which the USSR and other fraternal socialist states are waging for peace, against war and for social progress. This is precisely one of the manifestations of the new way of political thinking.

Footnote

1. For greater detail on the situation in the Near East, see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 4, 1988, pp 15-22.—Editor

U.S. Armed Forces Joint Strategic Transport Command

18010459b Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 10-15

[Article by Col V. Grebeshkov]

[Text] It was reported in the American press that in the second quarter of 1987 the Pentagon began forming a new operational organ of armed forces control—the Joint Strategic Transport Command, which will have its headquarters at Scott Air Force Base, Illinois. It is to provide operational leadership to all air, sea and land transportation resources at the disposal of the U.S. Armed Forces and earmarked for strategic transport of troops and cargo. These resources are presently distributed among the armed services, and in terms of administrative organization they fall within the composition of their principal commands. In particular air transportation resources (military transport airplanes and civilian airliners contracted during states of emergency) are managed by the air force's Military Airlift Command (MAC), marine transportation resources (organic ships and chartered civilian vessels) are managed by the navy's Military Sealift Command (MSC), and ground transportation resources (rolling stock and other ground transportation resources) are managed by the Military Transport Command of the ground troops (MTC).

In accordance with the Defense Department's plans each of these commands is responsible for transporting troops and cargo (by air, sea or land) in both peacetime and wartime. Air force, navy and army departments and staffs are responsible for providing personnel and equipment to their transport commands, for keeping them at a high state of combat and mobilizational readiness, and for allocating the needed quantity of transportation resources to carry out plans for strategic deployment of the armed forces.

Unique features of the USA's military and geographic position (the remoteness of its territory from both the main probable adversaries and the principal allies in the military-political blocs of Europe and Asia) are what the Pentagon uses to justify continual growth of troop mobility. The American leadership asserts that forward troop groupings must be maintained even in peacetime in Western Europe, in the Asia-Pacific region, in the Near and Middle East and in the Indian Ocean, and a sufficient strategic reserve of armed forces must be maintained in the continental USA.

The latter must be constantly ready for swift transfer to any region of the world. Resources for supporting strategic transport are being developed and improved in correspondence with the conception of "strategic mobility," which is an important component of American military doctrine. It reflects the global nature of the USA's aggressive aspirations and the intention of the military-political leadership of the United States to enlarge armed forces groupings in any region of the world in the interests of creating an advantageous correlation of forces there prior to the beginning of a war or in its course.

The idea of creating a joint strategic transport command has been circulating in the Pentagon for a long time. Its basic concept was formulated back in 1949, but the USA's Defense Department did not begin examining it in detail until the results of the Nifty Nugget command-and-staff exercise conducted in 1978 were analyzed. In the course of its critique the practical conclusion was made that a special organ had to be created in the armed forces to coordinate the efforts of the transport commands of the different armed services.

According to the newspaper AIR FORCE TIMES, the history behind this conclusion was as follows. In accordance with the scenario of the exercise it became necessary to enlarge NATO's joint forces in Europe quickly by transferring troops from the continental USA. However, when the measures were implemented in support of this mission, confusion was revealed in the way the use of air and sea transportation resources was planned, and much time was lost in attaining various mutual coordination between the transport departments and commands of the armed services. The exercise demonstrated the following: The air force Military Airlift Command was overburdened by transport requests which exceeded the possibilities of its transportation resources by more than three times; over 100 vessels assigned to the Military Sealift Command were in the Pacific zone during the exercise, and they could not be made ready quickly to transport troops and cargo across the Atlantic; storage of weapons and military equipment stockpiled in forward zones was poorly organized. Judging from assertions in the Western press, exercise Nifty Nugget demonstrated the low mobilizational readiness of the transportation resources of the air force, navy and ground troops, and most importantly, weak coordination between these armed services in relation to maintaining mobility.

A joint directorate was created at McDill Air Force Base, Florida to organize armed forces transport and deployment. It was given the task of coordinating the actions of the transport commands of the armed services and performing advisory functions during organization of the work of the joint deployment system. In addition it was given a computer information system used in the planning of deployment of armed forces in peacetime and in crisis situations in order to permit direct control of available resources supporting troop mobility.

In the estimation of American specialists, creation of this directorate significantly raised the effectiveness with which the transportation resources of all armed services were used. However, the eight-year experience of the directorate's activity revealed significant shortcomings in its organizational structure: The directorate was assigned the responsibility of uniting the efforts of the transport commands of the armed services with the goal of attaining the most effective use of the resources within their composition, but it was not given the authority to make decisions when differences arose. It did not have the right to make adjustments in the orders of the commanders- in-chief of joint commands of the U.S. Armed Forces in their zones of responsibility, and in the orders of the commanders of the Military Airlift Command, the Military Sealift Command and the Military Transport Command of the ground troops.

In order to correct this shortcoming the Pentagon decided to create the Joint Strategic Transport Command. The commander-in-chief of the Joint Strategic Transport Command (this post was assigned to General D. Cassidy, commander of the U.S. Air Force Military Airlift Command; on assuming his new position, he still remains commander of MAC) is endowed with all of the powers allowing him to directly organize the activities of the joint strategic transport system. He will possess command functions in relation to resources of the armed services placed under his operational subordination, which will make it possible for him to use them in the most effective and suitable manner.

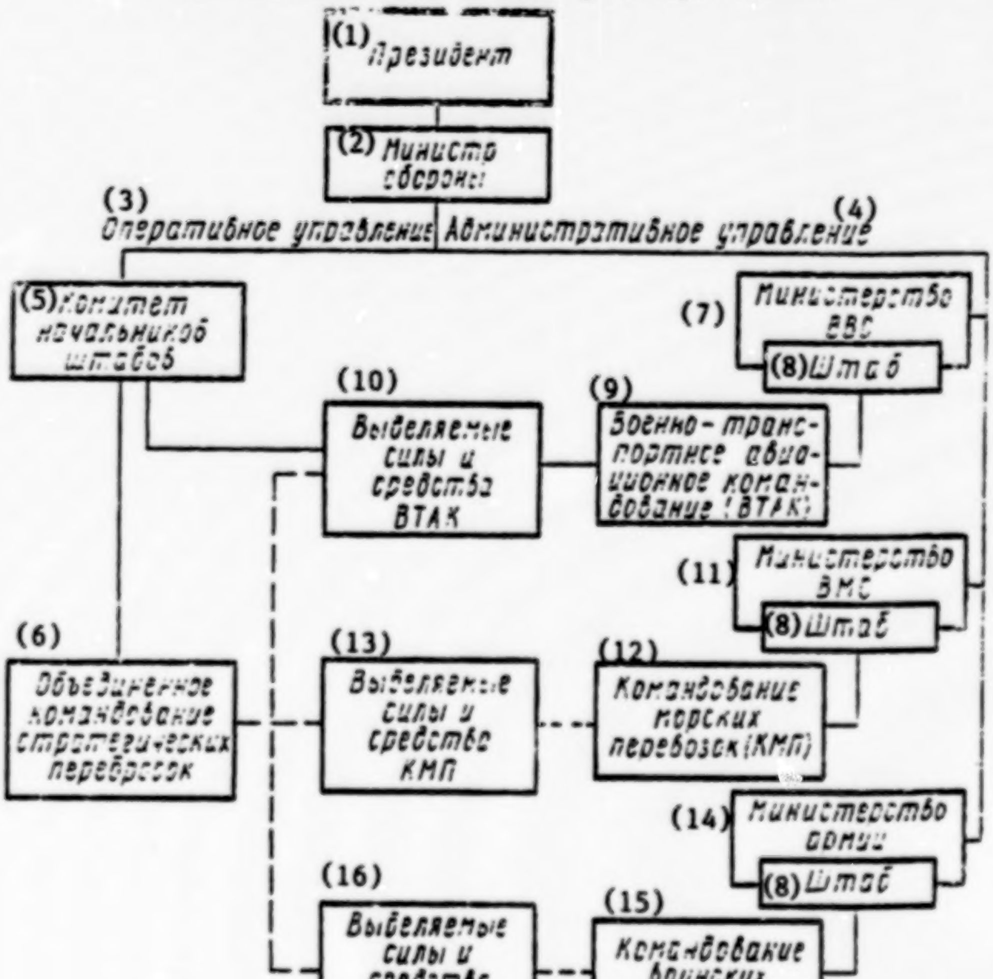
Mission and Composition of the Joint Strategic Transport Command

The new command is created on the basis of the functional principle; it is intended for wartime, and for participation in peacetime exercises conducted on the basis of plans of the Joint Chiefs of Staff. This means that in contrast to the seven other joint commands in the U.S. Armed Forces (for Europe, the Atlantic, the Pacific, Central and South America, and the space, central and special operations commands), the joint strategic transport command is not oriented on specific geographic regions, it should not contain strike forces within its composition, and it will not take a direct part in combat activities.

The principal mission of the joint strategic transport command will be to provide centralized leadership to the activities of all transportation resources managed by MAC, MSC and MTC in support of strategic troop deployments (enlarging existing armed forces groupings in forward areas and creating new ones), and providing comprehensive support to their combat activities. In other words the joint strategic transport command will directly manage air, sea and land transport in behalf of the armed forces on a global scale in a state of emergency prior to a war, during a war and during exercises.

The command should consist of a staff, which will be subordinated directly to the Committee of the Joint Chiefs of Staff, and resources placed under the operational subordination of the Joint Strategic Transport Command during a state of emergency from the Military Airlift Command, the Military Sealift Command and the Military Transport Command (see diagram). The headquarters of the JSTC will be located at Scott Air Force Base, Illinois in buildings being erected specially for it, near MAC Headquarters. The joint directorate for organization of transport and deployment will be its basis.

Basic Organization of the Joint Strategic Transport Command



Key:
1. President
2. Secretary of Defense
3. Operational directorate
4. Administrative directorate
5. Committee of the Joint Chiefs of Staff
6. Joint Strategic Transport Command
7. Department of the Air Force
8. Staff
9. Military Airlift Command (MAC)
10. Resources allocated by the MAC
11. Department of the Navy
12. Military Sealift Command (MSC)
13. Resources allocated by the MSC
14. Department of the Army
15. Military Transport Command (MTC)
16. Resources allocated by the MTC

The Military Airlift Command

The Military Airlift Command is composed of around 1,000 military transport aircraft of various types (in regular air force units and in Air Force National Guard squadrons and the Air Force Reserve Command assigned to MAC). According to reports in the foreign press this number includes up to 600 tactical transport airplanes (C-130, C-9 and others) having the mission of supporting airlifts within theaters of military operations and in a theater of war, and 308 strategic transport airplanes (74 C-5A and B Galaxies and 234 C-141B Starlifters), which are the principal means of supporting transcontinental strategic airlifts.

Four trained crews have been formed for each strategic transport airplane contained within units and subunits of the regular and reserve components of the air force, making it possible to use these aircraft continuously over a long period of time. In the estimation of American experts such a number of crews creates conditions allowing each C-5 and C-141 to remain on the ground just long enough for loading and unloading operations, refueling and the minimum necessary preflight preparations and preparations of the airplane for another sortie (not more than 12 hours per day). All the rest of the time they may remain in the air (conveying personnel and cargo or making the return flight), which ensures their highly effective use.

It is emphasized in the foreign press that the possibilities of strategic airlifts are not exhausted by the presence of just MAC's military transport airplanes. In a state of emergency, the so-called MAC reserve, consisting of civilian airline companies, is to be placed into operation. In the estimation of American experts it is capable of assuming over half of the airlifts (transports) of the Defense Department in states of emergency. This reserve includes 34 of the country's airline companies, which can provide a sum total of almost 400 passenger and cargo airplanes in a state of emergency. The bulk of them are wide-body B-747 and DC-10 airliners. Three levels of mobilizational readiness are established for airplanes of the civilian reserve and their crews. The number of aircraft and the time limits for converting flight crews to a military posture are determined for each of them.

MAC's military transport airplanes and some civilian airliners used on contract with the Defense Department convey up to 2.5 million persons and around 520,000 tons of various cargo each year during peacetime in behalf of the American Defense Department.

The military-political leadership of the USA attaches priority significance to development of airlift support resources in connection with the unique features inherent to them. It is felt for example that only transport aviation is capable of supporting initial deployment of the necessary troop contingents in crisis situations, and moreover before other strategic transport resources (naval in particular) have completed concentrating for loading. Air transport resources are also capable of transporting troops and cargo over great distances. Pentagon specialists feel that air transport resources play the highest role when the time factor is most important. And this in their estimation will happen rather often. It is no accident that the U.S. Air Force's Military Airlift Command has been awarded the status of a special command of the American armed forces permanently under the administration of the Committee of the Joint Chiefs of Staff.

Because of the importance of supporting strategic troop mobility, research was conducted in the late 1970s and early 1980s on the possibilities of MAC's air transport resources. American experts, who gave a high evaluation to their potential for carrying passengers, which satisfies and even exceeds all the needs of the armed forces, concluded that MAC is insufficiently effective when it comes to cargo shipments, especially in regard to oversized equipment (tanks, helicopters and so on), which only C-5 airplanes can carry for the moment.

The research resulted in development of an integrated long-range program for development of airlift support resources, which was adopted by the U.S. Congress in 1981 and foresaw an overall increase in the capabilities of MAC's strategic transport resources of over 2.5 times by the year 2000, and attainment of a level of 66 million ton-miles per day in this period, as coordinated with all armed services (this is an arbitrary indicator—the product of the cargo that is simultaneously carried aloft by all airplanes and the distance each of them covers in a day).

All previous plans for purchases and for modernizing MAC's airplane fleet were brought together under this program, to include lengthening the fuselage and installing an air-to-air refueling system in more than 230C-141As (this has already been done; after modernization, the airplane was designated the C-141B); replacing the wings of C-5As (completed in 1987); making additional purchases of 50 C-5B strategic transport airplanes and 60 KC-10 tankers and delivering them to the air force by 1990; reequipping some civilian passenger airliners as cargo- passenger liners. It is believed that fulfillment of these plans by 1992 will increase the capabilities of the USA's air transport resources to a level of 54 million ton-miles per day. Further growth of the capabilities of MAC's strategic resources to a level of 66 million ton-miles per day, planned for the year 2000, will be achieved through purchases of the C-17 transport airplane, presently under development, and its delivery to the air force (210 units).

Military Sealift Command

The Military Sealift Command (created in 1949) is intended to support armed forces with the necessary peacetime transportation resources and to achieve a high state of readiness for strategic transport of troops and cargo to remote theaters of military operations in a crisis and during a war. The commander of the MSC is

subordinated to the naval chief of staff, and he directs the zonal sealift commands (in the Atlantic and Pacific oceans, in Europe and in the Far East), created in the interests of direct organization and support of military cargo shipments in these regions of the world.

Ships of the MSC fall into two basic groups—TOE and non-TOE. The former include vessels owned by the state and intended to support the daily activities of armed forces in peacetime. The bulk of them are managed directly by organs of this command, and they are manned by MSC workers. The rest (chiefly tankers) are contracted out to private shipping companies and are serviced by civilian seamen. Non-TOE ships are commercial vessels chartered by the command from private shipping companies, and state-owned vessels transferred by the U.S. Transportation Department's merchant marine directorate to the Military Sealift Command on contract for a certain period of time. These are usually de-mothballed vessels of the National Guard's reserve fleet.

At the moment, according to reports in the foreign press, there are around 150 vessels in the MSC supporting the daily activities of the navy; up to 50 are to go into operation when strategic troop deployment begins, and with the breakout of war, around another 100 could be transferred to the MSC (from the ready reserve).

On the whole, Pentagon specialists believe, the effective ship strength of the MSC cannot be clearly determined, and it will depend on the demand for sea and ocean shipments. Thus at the height of the war in Southeast Asia (1968-1969), when the volume of sea shipments in behalf of the armed forces increased dramatically, the number of non-TOE vessels of the MSC attained 350 units.

As with the MAC, the MSC is continually implementing measures directed at raising the effectiveness of its resources. For example in recent years three squadrons of depot ships were introduced into the MSC to support the strategic mobility of three Marine brigades, eight fast container ships available for loading on four days' notice have been placed into operation, and there are plans for increasing the number of vessels in the ready reserve by 1992, and for increasing the number of ships ready for loading on 5-10 days' notice to 120 units (there are now 85 of them).

Military Transport Command

The Military Transport Command operates in behalf of all armed forces and the State Department as a whole both in the continental USA and in transoceanic areas in peacetime and in wartime. It possesses the necessary quantity of freight cars, tank cars and flatcars. The MTC maintains and services freight handling terminals at more than 40 different seaports, including foreign ones, supporting the transloading of cargo from ground transportation resources to ships and back (cargo is transloaded from air to ground transportation resources by MAC).

Judging from a statement by Pentagon representatives all of the above- mentioned strategic transport resources of the MAC, MSC and MTC will remain within the composition of the commands of the armed services. The present practice of daily air, sea and land shipments will remain practically unchanged: The headquarters of the American air force, navy and ground troops will continue to control their own transport commands and maintain responsibility for fulfillment of missions inherent to the particular forms of transportation resources. Moreover before the headquarters of the JSTC goes into operation, the Military Airlift Command will continue to maintain the status of a special command of the U.S. Armed Forces subordinated operationally to the Committee of the Joint Chiefs of Staff.

In peacetime, the Joint Strategic Transport Command will be represented only by the JSTC headquarters. Its chief mission would be to plan strategic transfers of troops and cargo at the time of their mobilizational deployment, in application to different variants of the start and conduct of wars (presently existing and under development). Its responsibilities also include drawing up and checking these plans in the course of various exercises, which in the estimation of American specialists makes the operational deployment plans more realistic.

All data necessary for the planning of strategic troop deployments will be processed by means of an automated information collection and processing system consisting of the corresponding information subsystems of the air force, navy and ground troop transport commands. Receiving and evaluating the data from this system, the commander-in-chief of the JSTC would be in a position to effectively utilize available air, sea and land transportation resources.

It was reported in the foreign press that the headquarters of the Joint Strategic Transport Command of the U.S. Armed Forces is to be formed in four stages.

In the first (April-October 1987), the full complement of the joint directorate for organizing transport and deployment (143 persons) was transferred to the JSTC headquarters. It will continue to be based at McDill Air Force Base in Florida. The directorate is to be transferred to the location of the JSTC headquarters at Scott Air Force Base, Illinois, where it will occupy a building specially erected for it, at the end of the third stage. In this same period another 200 persons, including up to 50 officers and generals, from MAC and the other commands will occupy vacancies in the JSTC headquarters.

The second stage should last until early July 1988. By this time the JSTC headquarters is to be fully staffed to 462 persons, and all problems associated with coordination with joint zonal commands of the U.S. Armed Forces are to be solved and planning is to be initiated.

In the third stage (until October 1988) all work on the problems of the organizational structure of the JSTC headquarters is to be completed, the functional responsibilities of its officials are to be approved, and all documents are to be submitted to the U.S. Committee of the Joint Chiefs of Staff for approval.

The fourth stage should last 2 years (from October 19[illegible] to October 1990), and it should play the role of a trial period. Several command- and-staff exercises are to be carried out during this period in order to work out the problems of strategic deployment of troops and their transfer to various theaters of military operations (the exercises will be led by the JSTC headquarters).

On the whole, creation of the Armed Forces Joint Strategic Transport Command attests to the aspiration of the American military-political leadership to continue its militaristic foreign policy course by implementing a complex of measures directed at increasing the strategic mobility of the troops, especially in a state of emergency.

Spread of AIDS in the U.S. Armed Forces

18010459c Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 15-16

[Article by Col A. Petrov]

[Text] According to information published in the American press, the number of carriers of the AIDS (acquired immune deficiency syndrome) virus in the country's population attained almost 2 million in February 1988; 52,000 had an advanced form of the disease, and about 27,000 had already died. According to estimates of the World Health Organization, the quantity of patients and carriers of the virus may double every 12 months in countries where AIDS is highly widespread, which includes the United States.

In the USA the disease affects all regions and strata of the population, including military servicemen, to one degree or another. Testing of applicants for military service and all personnel for the AIDS virus was introduced into the armed forces by orders of the secretary of defense on 30 August and 24 October 1985. Measures foreseen by these orders have the purpose of preventing the spread of infection among servicemen and keeping this factor from influencing the combat readiness of the troops.

By early 1988 the Defense Department published some results of the measures. In particular it was reported that in the period from 1 October 1985 to April 1987, around 1 million persons were tested at recruiting stations; among them, 0.15 percent were infected with this virus. All carriers were excluded from the recruits. Two hundred patients with the active form of AIDS and 2,576 carriers of the virus were revealed among servicemen of all categories.

AIDS patients are subject to a medical discharge from the armed forces. Persons infected with the virus (carriers) may in formal terms remain in the service, but a number of significant limitations have been established in relation to them. In particular, they can serve only in units and services that are stationed on U.S. territory and for which there are no plans for redeployment to other countries. Command personnel were given the responsibility of freeing carriers of this virus from positions involving large physical and psychological loads. Placing them in jobs associated with presence in unfavorable climates and with the possibility of contracting infectious diseases is not recommended either. Specialists feel that infection by some new disease or the immunizations necessary for unfavorable epidemic conditions could worsen the health of carriers of the AIDS virus, and cause transition of the infection into a pronounced clinical form.

When persons infected with this virus are assigned, steps are taken to protect the health of both themselves and servicemen working side by side with them. Carriers of the AIDS virus have been made responsible for strictly observing sanitation and hygienic requirements (particularly in regard to sexual relations) in order to preclude infection of other persons in their milieu. Disciplinary and judicial liability is foreseen for cases where these requirements are violated. By order of the secretary of defense, identified carriers are subject to exclusion from military academies, military schools and some units.

Besides servicemen, the units and services of the Defense Department employ around 1 million civilian workers. At present they are not subject to mandatory testing for presence of AIDS virus antibodies. However, the Defense Department is examining the need for this measure in application to civilians hired for positions in units and military services stationed outside the USA.

Testing of recruits for AIDS virus antibodies revealed that carriers are encountered significantly more frequently (by about five times) among blacks and Latin Americans. This imbalance had been noted earlier in surveys of infection by this virus both in the USA and in some other countries. In this connection some specialists have made the suggestion that susceptibility to the AIDS virus may be dependent on ethnic features.

Much attention is devoted in the U.S. Armed Forces to publicizing sanitation and hygienic measures to prevent infection by AIDS. In view of the absence of dependable

immunopreventive and therapeutic drugs by which to combat the disease, American specialists view these explanations as the main direction of fighting the epidemic. Their purpose is to teach the personnel how to avoid infection on one hand, and how to overcome the unjustified fear of the possibility of infection in various personal conditions on the other. These measures are based on the following principles of controlling the epidemic: The principal attention should be focused on preventing infection, and not on treating persons already infected; AIDS is an infection transmitted chiefly through sexual contact; presence of AIDS patients or carriers of the virus within a group should not be feared, since there is presently no information indicating that this infection is transmitted under normal living circumstances; AIDS is an extremely dangerous disease to which everyone is potentially susceptible.

The press has reported that measures to prevent the spread of AIDS are being publicized among personnel of the headquarters of the supreme commander-in-chief of NATO joint forces in Europe (Belgium), and family members of servicemen from NATO countries living in Belgium.

Measures to control the disease have included conducting lessons with servicemen and civilians, separately (in stages) depending on their service position and age. The information was initially provided to executive general and officer staff. The idea here was that on acquainting themselves with the principles of preventing disease and recognizing the importance of such measures, commanders would require their fullest possible implementation by subordinates at all levels. Then the corresponding lessons were conducted separately with the rest of the staff officers, NCOs, privates and civilian personnel: with instructors in higher and secondary educational institutions attended by the children of servicemen, and with parents, college students and secondary school students up to their fifth year inclusively.

In the opinion of specialists, holding these lessons separately for different groups makes them more understandable and purposeful, inasmuch as a possibility exists for concentrating attention in each case on problems that would be most pertinent to persons of the given category and age. Information on the features of the AIDS epidemic and on specific methods of preventing infection by this virus was transmitted to students in the course of the lectures. Visual aids taking the form of slides and posters were widely employed. There are plans for repeating similar lessons each year.

Support Command of the U.S. Ground Troop Airborne Assault Division

18010459d Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 17-21

[Article by Col V. Fedorov]

[Text] The advent of new forms and methods of warfare in the postwar era and introduction of highly effective weapons and military equipment into the troops are not only raising the combat capabilities of U.S. ground troops but also, in the opinion of Pentagon specialists, posing a number of problems to them in regard to rear support. This pertains especially to the airborne assault division, which was created in the early 1960s in accordance with the conception of "maximum mobility of tactical-level forces," and which was initially called the airmobile division.

According to the foreign press, saturation of the airborne assault division with helicopter gunships and transport helicopters equipped with modern weapons made it possible to raise its combat readiness and provided the commander a possibility for quickly maneuvering and concentrating the necessary resources at the needed time and in the needed place. The first possibilities of an airmobile division for conducting combat activities were tested during the aggressive war in Vietnam. This made it possible for the American command not only to improve the principles of the combat use of its units and subunits, but also to create a rear support system, based on a rear command, corresponding to them.

Structure

The support command of an airborne assault division is headed by a rear services chief, who is subordinated directly to the division commander and who bears responsibility for organizing and providing material, technical, medical and other forms of rear support to organic and attached units and subunits. A logistic support center, a headquarters and headquarters company, the general adjutant's company, a financial company and four battalions—medical, supply and service, repair, and aircraft equipment repair—are subordinated to him. The strength, armament and hardware of the units and subunits of the support command are presented in the table.

Personnel Strength and Basic Armament of the Support Command of a U.S. Airborne Assault Division

Personnel and Armament	Logistic Support Center	Headquarters and Headquarters Company	General Adjutant's Company	Financial Company	Medical Battalion	Supply and Service Battalion	Repair Battalion	Aircraft Equipment Repair Battalion	Total
Personnel	167	156	281	88	396	488	612	560	2,748
Including officers	16	32	12	6	66	22	30	12	200
40-mm grenade launchers	2	2	8	4	-	12	13	18	59
7.62-mm machine-guns	8	12	8	8	-	44	38	32	150
5.56-mm automatic rifles	155	143	273	80	360	484	606	524	2,625
Pistols	8	10	11	11	35	-	8	36	119
Telephone sets	19	18	13	12	54	59	82	45	302
Telephone switchboards	2	1	2	1	6	8	6	3	29
Motor vehicles	35	29	26	4	78	147	150	106	575
Fork-lift trucks	-	-	-	-	-	8	-	2	10
Vehicle-mounted cranes	-	-	-	-	-	-	-	8	8
Portable pump units	-	-	-	-	-	16	-	-	16
19-ton fuel tanks	-	-	-	-	-	16	-	-	16
Mobile fueling points (230 tons each)	-	-	-	-	-	5	-	-	5
Helicopters	-	-	-	-	-	-	-	4	4

The **logistic support center** is the working organ of the division's chief of rear services, and it is intended to carry out the following basic tasks: preparing operational rear support data needed by the chief of rear services to make decisions; organizing coordination with the logistical support center of the army corps support command on evacuating materiel and providing assistance to the division's support command; estimating the amount of troop logistical support work; collecting, generalizing and analyzing work orders pertaining to all forms of rear support; preparing information and reference materials on rear support problems in accordance with directives from the division commander.

The **headquarters and headquarters company** carry out the tasks of controlling rear units and subunits stationed within the division's zone of responsibility, and they carry out automated processing of data necessary for organizing troop rear support. As a rule, subunits of the headquarters and headquarters company deploy 2-3 km from the division's rear control point, in the division's rear area.

The **general adjutant's company** is intended to provide field services to the personnel of the division's organic and attached units and subunits. The company's resources deploy in the division's support area.

The **financial company** deals with the problems of financial support to the division's personnel.

The **medical battalion** carries out the tasks of providing emergency medical care to casualties and delivering them to battalion, brigade and division medical points, conducting triage on casualties, treating light casualties at medical points prior to their return to the ranks, and preparing serious casualties for evacuation. The battalion has a headquarters and one headquarters and three medical companies, each of which deploys a medical point in one of the brigade support areas to treat the casualties of the supported brigade and of subunits attached to it.

The **supply and service battalion** receives materiel, maintains stockpiles of supplies and issues them to combat units and subunits. It includes a headquarters and a headquarters detachment, and the following companies: supply and service, motor transport and three forward supply and service.

A supply and service company deploys in the division support area with the purpose of supplying materiel to the division's units and subunits.

The motor transport company is intended to deliver materiel of the basic types (fuel, ammunition, food) from division to brigade supply points.

Forward supply and service companies, which supply the division's combat brigades, deploy in rear support areas.

The **repair battalion** repairs and restores damaged weapons and military equipment and supplies the appropriate spare parts to vehicle crews and teams. It consists of a division headquarters and the following companies: repair, missile repair and three forward repair.

The division's repair company deploys in the division's rear area. It repairs weapons and military equipment (except for missiles and aircraft equipment) in the inventory of the division's units and subunits, both organic and attached.

The missile repair company also deploys in the division's rear area and repairs damaged antitank guided rocket launchers, surface-to-air guided missiles, multiple rocket launchers and other missile armament with which the division is equipped.

Forward repair companies deploy in brigade rear support areas and carry out the tasks of repairing broken-down weapons and military equipment with which the brigades are armed, and of evacuating damaged equipment which they cannot repair to division damaged vehicle collection points.

The **aircraft equipment repair battalion** is intended for technical maintenance and repair of aircraft equipment and helicopters of the division's army aviation. It includes a headquarters, a headquarters detachment and two repair companies. All of the battalion's subunits deploy in the division rear area, near the bases of the division's army air subunits.

Rear Support Organization

It is reported in the foreign military press that the resources of the division support command and the rear subunits of brigades, battalions and companies deploy in the corresponding rear support areas.

A division rear support area (around 10 km^2) is a component of the division's rear area. Its location is determined by the chief of the division's support command in coordination with the deputy commander and chief of the operations section of division headquarters. The headquarters of the support command deploys within it together with the bulk of its organic and attached resources—the headquarters company, the headquarters of the technical airlift support battalion, the supply and service battalion, the medical battalion, the repair battalion, the general adjutant's company, the financial company, the division's logistic support center and the helicopter airlift battalion. The division rear area contains the division's combat support units and subunits as well as some attached units and subunits. Leadership of units and subunits in the division rear area is assigned to the chief of the operations section of the division headquarters, and in the rear support area, to the chief of the division's support command.

All materiel necessary for the supply of the division's units and subunits is stored in the rear supply area. In correspondence with existing requirements the materiel reserve must support the division's combat activities for 3 days (around 4,000 tons of supplies), and 5 days in some cases.

Supplies are delivered to brigade rear support areas and partially to the division rear area from the division's rear support area, which is set up as a rule up to 100 km from the line of contact with the enemy, and 60 km from brigade rear support areas. The principal means by which units and subunits of the division's first echelon are supplied is transfer of materiel by air in cargo helicopters. Army corps motor vehicle and air transportation may be used to deliver certain supply items from corps depots.

Subunits allocated to provide services to **brigades** are deployed in their rear support areas, 40-60 km from the line of contact. The brigade rear usually includes an administration, a liaison officer for coordination with forward rear subunits, a medical company (intended to provide assistance to casualties and patients, evacuate them to medical facilities in the rear, and supply the brigade's subunits with the necessary medical equipment and supplies), a repair company (collects and repairs damaged equipment or evacuates it to higher repair echelons, and supplies the brigade's subunits with spare parts), a supply and service company (provides the brigade's subunits with materiel by way of supply points set up by its resources), an army aviation equipment repair team (when necessary) and other subunits.

Rear support is managed by the brigade deputy commander for rear services. He provides assistance to the corresponding brigade officers in planning rear support, keeps them informed on the capabilities of the division's support command and its limitations that may have an influence on the course of combat activities, collects messages concerning rear services from subunits in the brigade rear area and sends them to the division logistic support center. He also bears responsibility for organizing communication in behalf of subunits providing combat and rear support, for traffic control and for evacuation of casualties and patients to the appropriate medical facilities. In coordination with the brigade deputy commander for rear services he draws up the plans for rear support to subunits operating within the brigade's area of responsibility.

Concentrating subunits possessing resources which can be used to provide assistance to casualties and to evacuate and repair broken-down combat equipment in the rear support areas of infantry airmobile **battalions (companies)** is recommended. Thus judging from reports in the foreign military press, damaged vehicle collection points are set up and medical points are deployed in companies and battalions. Depending on the combat mission and the particular situation, small reserves of food, POL, ammunition and so on may be created in battalions and companies.

It is noted in American manuals that brigade tactical groups are formed in the division for combat activities. They consist of three infantry airmobile battalions, two tactical troop-lift helicopter companies, one antitank helicopter and one transport helicopter company, and various combat and rear support subunits—artillery, reconnaissance, antiaircraft, engineer, military police and rear services. In the opinion of Western specialists the success of combat activities carried on by the forces of a brigade tactical group will depend in many ways on the dependability of its rear support, for which purpose the division's support command may provide supply and service, repair and medical companies that deploy deep within the group's area of responsibility, out of range of enemy artillery. Rear subunits are managed by a liaison officer for coordination in the forward area.

The problems of uninterrupted supply of ammunition, POL, food and so on to these groups occupy an important place in the overall system of rear support to their combat activities. Materiel is to be delivered from the division's rear support area to brigade tactical groups by the division's resources, and in some cases, on the basis of the appropriate orders, by military airlift aircraft (cargo is dropped by parachute or unloaded on prepared pads). Depending on the given situation ammunition, fuel and so on may be delivered directly to battalion rear support areas. Delivery of materiel from brigade to battalion rear support areas is organized predominantly with the assistance of the transport helicopters of the division's army air brigade.

American military specialists feel that the main goal of supply is to deliver materiel as close as possible to the troops being supported. Thus ammunition may be delivered by helicopters directly to the combat formations of artillery, mortar and infantry airmobile subunits. It is felt that use of this supply method makes it possible for the commander of the brigade tactical group to react more flexibly to changes in the combat situation and to carry out his missions more successfully.

So-called "light" and "heavy" rear support teams have been created at exercises in recent years. They were transferred to particular areas of simulated combat activities in order to raise the effectiveness of current rear support or restore defunct rear support to the subunits of brigade tactical groups.

A "light" rear support team (20 persons, 6 motor vehicles, refueling and repair equipment) may carry out the tasks of receiving, storing and supplying all necessary materiel to a brigade's combat subunits, carry out simple armament repairs and provide limited medical services to the personnel. Creating such teams is recommended in the event that the brigade tactical group must carry out special missions, or in order to support subunits operating apart from the main forces.

The "heavy" team (around 50 persons, 13 motor vehicles, a tactical troop-lift helicopter, refueling and repair equipment) is intended to refuel combat equipment, evacuate casualties and patients to the rear, receive, store and issue the necessary materiel to supported subunits, repair certain types of armament and communication equipment, and collect and evacuate damaged combat equipment. It is to be used most often for support of movements of the brigade's rear subunits, and of the combat activities of subunits operating apart from the main forces in an independent sector.

On the whole, the ground forces command believes that the presently existing system of rear support to the airborne assault division satisfies the requirements imposed on it and is capable of carrying out the tasks of supplying materiel, repairing weapons and military equipment and providing medical support to personnel in different combat situations.

Supplying Water to Troops in the Field

18010459e Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 27-28

[Article by Lt Col Yu. Belov, candidate of military sciences, based on the views of American military specialists]

[Text] The U.S. ground forces command devotes considerable attention in its war preparations to organizing rear support to troop combat activities. Among the tasks facing rear services, units and subunits, the problems of supplying drinking water to troops in the field occupy a special place. Owing to possible contamination and destruction of surface water sources within vast areas, water supply acquires even greater significance when combat activities involve the use of mass destruction weapons. Research conducted by the U.S. Army aimed at solving the problem of supplying water to the troops has been reported in the foreign military press. The solutions include developing and testing new field water supply equipment, creating modern water extracting equipment and seeking improved water purification methods. In addition to this, steps are being taken to teach the personnel how to survive in the absence of water when fighting in desert and arid regions with a hot climate.

Foreign military specialists feel that when combat activities are conducted in poorly equipped theaters of military operations in arid regions (particularly in the Near East), the water demand of the troops is 1.5-2 times greater than in the conditions of other theaters. This is the product of complex climatic and geographic conditions, considerable remoteness of water sources from each other, and limited availability of ground water due to the considerable depth at which the water-bearing beds exist and their high mineral content. This is why supplying water to troops conducting combat activities under such conditions is one of the main and most complex tasks of the rear. Thus for example, supplying drinking water to troops by means of special water extracting, purifying and transporting equipment was one of the principal tasks of engineer and rear subunits during "Bright Star" exercises conducted on desert terrain. The greatest difficulties arose in regard to protecting the water from spoilage. It was noted at the exercise critique that on the whole, the engineer and rear units and subunits were able to carry out their task of supplying drinking water to the troops and satisfying personnel washing and laundry needs. But at the same time certain weaknesses were pointed out as well: The organization and equipment of engineer subunits did not fully satisfy modern requirements, water extraction, purification and storage equipment was for the most part obsolete, interruptions in troop water supply occurred, adequate coordination between rear subunits and engineer subunits was lacking, and so on.

In this connection the command of the U.S. army declared outright that it viewed supplying troops with water in the field to be the performance of a combat mission, and that it believes it is necessary to have, for example within the composition of "rapid deployment forces," units and subunits which would carry out the tasks of supplying drinking water to the troops in close coordination with the missions facing the combined-arms units and subunits.

It is emphasized in American manuals that the responsibility for providing drinking water to the troops is assigned to the commanders of combined-arms units, engineer troop subunits and the medical service. Engineer subunits scout the sources and they extract, treat and distribute the water. The medical service is called in to determine the degree of the water's contamination and the concentration of toxic impurities. In addition the troops themselves are obligated to purify water using their own purification devices. On the whole, the process of supplying troops with water in the field consists of the following stages: scouting the sources, determining the quality of the water, and extracting, treating and distributing it.

The army department's scientific research facilities are conducting research aimed at determining water consumption norms for personnel and combat equipment. It is reported in the foreign press that water consumption norms pertaining to combat activities in different theaters of military operations have basically been determined, and the corresponding proposals on supplying water to troops in the field have been drawn up. The greatest emphasis is made in the research on the problem of maintaining the combat capabilities of troops conducting combat activities in arid and desert regions with a hot climate. It was established as a result of the work and subsequent tests carried out during exercises that the average water consumption norm, expressed per person per day, is approximately 80 liters, including 20 liters for personal consumption and hygiene, 15 liters for food preparation, and the rest for other needs. American military specialists feel that this is the optimum norm, although they do not exclude possible deviations.

It is reported in the foreign military press that daily water consumption during combat activities in such regions is very great, and difficulties are encountered in extracting, purifying, cooling and delivering the water to users. Thus a troop grouping with a strength of 250,000 men would require over 10 million liters of water per day. This does not appear to be difficult when combat activities are conducted in equipped theaters of military operations and in regions with a moderate climate and a sufficient quantity of water sources. Things are entirely different in desert and arid regions with a hot climate. Here it is difficult to scout for and extract water, and its preservation and delivery are a complex problem. This is why the corresponding documents make organizing rigid control over water consumption and ensuring its preservation and adoption of the necessary measures against spoilage one of the responsibilities of commanders of all ranks.

The problems of determining the most optimum organization of the corresponding units and subunits, equipping them and developing general principles of troop water supply occupy an important place in troop water support in the field. According to the foreign military press measures to improve the structure of existing subunits and to form new ones capable of scouting for, extracting, purifying and storing water with sufficient effectiveness, especially in regions with a hot climate, are being implemented today within the framework of the reorganization being conducted in the ground forces (the "Army-90" program).

Observing the following principles is recommended when organizing combat activities in desert and arid regions. Those subunits that are to make contact with the enemy first are provided with the necessary reserve of water (canteens, insulation-covered barrels and so on). Water is replenished as it is consumed by ground transportation, field pipelines, helicopters, and in some cases even airplanes (in special containers). If combat activities are to be conducted in relative proximity to the seacoast, the troop water supply scheme may appear as follows. A central base for storage and distribution of water brought in from tankers and barges, from seawater intake stations after its freshening and purification, and

from surface and underground sources by pipeline are to be deployed within reach of the lines of communication of the troop grouping. From there, the water is delivered to central points (with a capacity of around 2 million liters each), corps points (over 3 million liters) and division, brigade and forward points. Water may be delivered to consumers from forward storage and distribution points by the resources of the consumers themselves or the higher chief. In a division these tasks are assigned to the brigade rear support battalion, and in a corps they are assigned to special engineer and rear subunits.

American military specialists emphasize that supplying water to the troops is now one of the main problems in maintaining the combat capabilities of the personnel and the readiness of combat equipment. Creating reserves of water, and purifying and chilling it, are recommended to the extent possible in this connection. Today, as the foreign press notes, efforts are under way to create modern equipment for seeking, extracting and purifying water, new resources for transporting water are being adopted, including flexible containers, and more-effective methods of organizing troop water supply in the field are being sought. All of these measures, according to statements by American specialists, should ensure the possibility for conducting combat activities in weakly equipped theaters of military operations, including in desert and arid regions with a hot climate.

In Aid of the Commander: Basic Tactical Standards

18010459f Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 29-30

[Text] The armored cavalry squadron of an armored cavalry regiment[1] of the French 6th Armored Cavalry Division (included in the "rapid deployment forces") may operate both as part of the regiment and independently, carrying out the missions of covering a forward defense area security zone or the flanks of friendly troops, conducting reconnaissance and fighting enemy tanks (if it is provided with the needed resources).

A squadron operating within the composition of covering forces may be assigned a parcel of ground with a front of 5-7 km and a depth of up to 4 km. The combat formation is usually organized into two echelons in this case.

Four reconnaissance patrols of up to platoon strength each or 12 of up to squad strength may be allocated and around 20 observation posts, including two radar reconnaissance posts, may be organized out of its resources for reconnaissance purposes.

A reconnaissance patrol consisting of a platoon may conduct reconnaissance in a zone up to 10 km wide and up to 20 km deep.

The airborne company of a parachute regiment[2] of the French 11th Airborne Division may carry out its missions within the composition of "rapid deployment forces," capture and hold tactically important pieces of ground, and conduct reconnaissance in the enemy rear. In certain cases it is to be used to organize and conduct offensive (defensive) combat activities as part of a regiment, or independently.

In offense, the company may be dropped (landed) as part of a tactical airborne force in the direction of concentration of the main efforts of the troops, at a depth of 60 km or more. Transfer of its personnel requires up to 10 SA 330 Puma tactical troop-lift helicopters or three or four C-160 Transall military transport aircraft. The dropping height is 500-1,500 m.

The width of the company's front of advance is up to 1.5 km (up to 400 m for a platoon and 80 m for a squad).

The objective of the attack and the direction of subsequent advance are designated to the company.

The combat formation is usually organized into two echelons.

In defense, the company, which operates as part of a regiment as rule, may carry out the missions of covering the flanks, fighting armored targets and so on. In certain cases it may defend a strongpoint with a width of up to 2 km and a depth of up to 1.5 km.

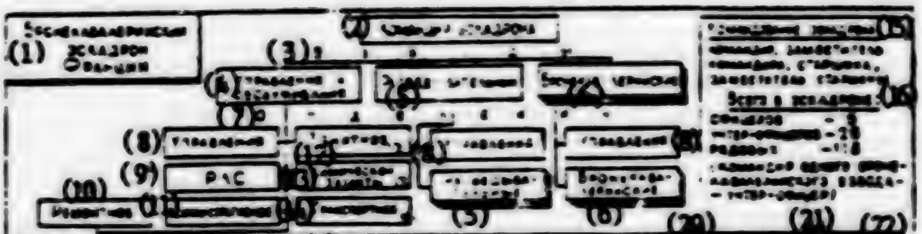
The alpine infantry company of an alpine infantry battalion[3] of the French 27th Alpine Infantry Division can carry out reconnaissance and sabotage missions in the enemy rear, and it can conduct conventional combat activities independently or as part of a battalion. In this case it will operate in its first or second echelon, or it will be held in reserve.

In offense, the company may operate for 3-5 days as a reconnaissance and sabotage detachment 10-15 km away from the line of contact in a zone up to 5 km wide. The principal method of action in offense is striking the enemy in the flank and rear after infiltrating through his combat formations or bypassing them. When conducting conventional combat activities it may be given an attack objective and the direction of subsequent advance. In this case the combat formation would be organized into two echelons, with three platoons in the first.

Possible reinforcements include a mortar squad (two 81-mm mortars) or an antitank squad (two Milan antitank guided rocket launchers).

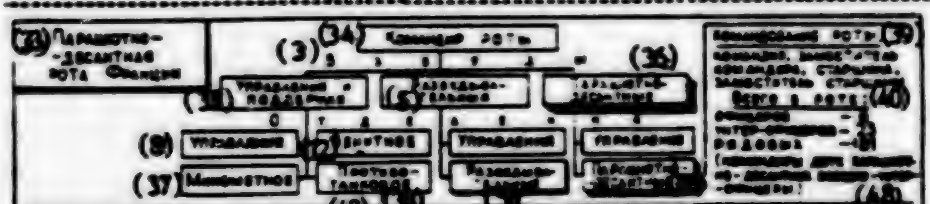
In defense, the company operates depending on the specific terrain conditions, setting up positions on commanding heights, on passes, in ravines and so on.

A company on the march can climb up to 1,000 m on foot in 3 hours and in helicopters in 5 minutes, and it can climb to a height of 1,500 m in 6 hours and 15 minutes respectively. The rate of descent on foot is up to 500 m/hr.



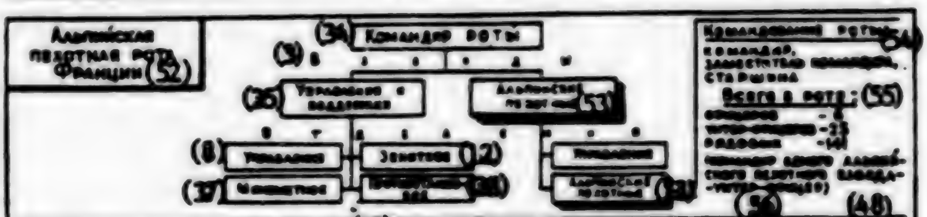
(17) Личный состав, основное вооружение	(18) Командир эскадрона	(19) Взвод управления и обслуживания: Упр.	Зен.	РЛС	[illegible]	[illegible]	[illegible]	[illegible]	Во взводе	(20) Упр.	[illegible]	Во взводе	(21) Упр.	[illegible]	Во взводе	(22) Всего в эскадроне
Личный состав, человек	4	12	5	5	5	5	8	5	48	7	6	25	12	4	25	150
БРМ AMX-10RC	–	–	–	–	–	–	–	–	–	–	–	–	1	1	4	12
БТР VAB	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	1
20-мм зенитные пушки	–	–	2	–	–	–	–	–	2	–	–	–	–	–	–	2
89-мм РПГ	–	2	–	–	–	–	–	–	2	1	–	1	1	–	1	6
7.5-мм пулеметы M52	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	1
5.56-мм авт. винтовки MAS	–	7	[illegible]	4	[illegible]	5	[illegible]	4	30	2	2	8	6	1	9	69
9-мм пистолеты и пист.-пулеметы	4	6	2	2	[illegible]	[illegible]	[illegible]	[illegible]	16	5	4	17	[illegible]	3	18	25
Радиостанции	–	[illegible]	–	1	[illegible]	–	2	[illegible]	11	2	2	8	3	1	6	37
Автомобили	–	1	1	1	–	–	[illegible]	2	[illegible]	2	2	8	1	–	1	18

(57)



(17) Личный состав, основное вооружение	(41) Командование роты	Взвод управления и поддержки: Отделения Упр.	Мин.	Зен.	ПТ	Во взводе	Отделения Упр.	Развед.	Во взводе	Отделения Упр.	Пар.-дес.	Во взводе	Всего в роте
Личный состав, человек	4	14	6	5	6	31	7	10	27	7	10	37	210
ПУ ПТУР "Милан"	–	–	–	–	2	2	–	–	–	–	–	–	2
81-мм минометы	–	–	2	–	–	2	–	–	–	–	–	–	2
20-мм зенитные пушки	–	–	–	2	–	2	–	–	–	–	–	–	2
89-мм РПГ	–	2	–	–	–	2	–	1	2	2	1	5	24
7.5-мм пулеметы M52	–	1	–	–	–	1	–	–	–	–	–	–	1
7.5-мм снайп. винтовки F1	–	–	–	–	–	–	–	–	–	–	1	3	12
5.56-мм авт. винтовки MAS	–	12	4	3	3	22	6	9	24	5	8	29	162
9-мм пистолеты и пист.-пулеметы	4	1	2	2	3	8	1	1	3	2	1	5	35
Радиостанции	–	5	2	–	2	9	3	4	11	2	2	8	52
Автомобили	–	5	–	–	–	5	–	–	–	–	–	–	5

(43) (44) (45) (47)



(17) Личный состав, основное вооружение	(41) Командование роты	Взвод управления и поддержки: Отделения Упр.	Зен.	Мин.	ПТ	Во взводе	Альпийский пехотный взвод: Отделения Упр.	Альп.-пех.	Во взводе	Всего в роте
Личный состав, человек	3	4	5	5	5	19	7	10	37	170
ПУ ПТУР "Милан"	–	–	–	–	2	2	–	–	–	2
81-мм минометы	–	–	–	2	–	2	–	–	–	2
20-мм зенитные пушки	–	–	2	–	–	2	–	–	–	2
89-мм РПГ	–	–	–	–	–	–	–	1	3	12
7.5-мм пулеметы M52	–	–	–	–	–	–	–	1	3	12
5.56-мм авт. винтовки MAS	–	2	3	3	2	10	8	8	30	130
9-мм пистолеты и пист.-пулеметы	3	2	2	2	3	9	1	1	4	28
Радиостанции	–	2	–	2	2	6	2	2	8	36
Автомобили	–	3	2	3	2	10	–	–	–	10

(58)

Key:
1. French armored cavalry squadron
2. Squadron commander
3. Platoons
4. Control and service
5. Reconnaissance
6. Armored cavalry
7. Squads
8. Control
9. Radar
10. Repair
11. Administrative
12. Antiaircraft
13. Antichemical
14. Transportation
15. Squadron command: commander, deputy commander, first sergeant, deputy first sergeant
16. Total in squadron: 6 officers, 26 NCOs, 118 privates (the commander of one armored cavalry platoon is an NCO)
17. Personnel, basic armament
18. Squadron command
19. Control and service platoon
20. Reconnaissance platoon
21. Armored platoon
22. Total in squadron
23. Personnel
24. AMX-10RC combat repair shop
25. VAB APC
26. 20-mm antiaircraft cannons
27. 89-mm antitank rocket launchers
28. 7.5-mm M52 machineguns
29. 5.56-mm MAS automatic rifles
30. 9- mm pistols and machine pistols
31. Radio stations
32. Motor vehicles
33. French airborne company
34. Company commander
35. Control and support
36. Airborne
37. Mortar
38. Antitank
39. Company command: commander, deputy commander, first sergeant, deputy first sergeant
40. Total in company: 6 officers, 23 NCOs, 181 privates (the commanders of two airborne platoons are NCOs)
41. Company command
42. Control and support platoon
43. Mortar
44. Antitank
45. Reconnaissance
46. Airborne platoon
47. Airborne
48. Total in company
49. Milan antitank guided rocket launchers
50. 81-mm mortars
51. 7.5-mm F1 sniper rifles
52. French alpine infantry company
53. Alpine infantry
54. Company command: commander, deputy commander, first sergeant
55. Total in company: 6 officers, 23 NCOs, 141 privates (the commander of one alpine infantry platoon is an NCO)
56. Alpine infantry platoon
57. Total in platoon

Footnotes

1. An armored cavalry regiment contains five squadrons (800 persons): control and service, three armored, and antitank. It possesses 12 Hot antitank guided rocket launchers, 6 Mistral antiaircraft missile systems, 4 20-mm antiaircraft cannons, 36 AMX-10RC combat repair shops, 43 VAB armored personnel carriers and other armament.

2. A parachute regiment contains six companies (1,250 persons): control and service, reconnaissance and support, and four airborne. it possesses 24 Milan antitank guided rocket launchers, 6 Mistral antiaircraft missile systems, 6 120-mm and 8 81-mm mortars, 14 20-mm antiaircraft cannons and other armament.

3. There are five companies in an alpine infantry battalion (920 persons): control and service, reconnaissance and support, and three alpine infantry. It possesses 14 Milan antitank guided rocket launchers, 6 Mistral antiaircraft missile systems, 6 120-mm and 6 81-mm mortars, 10 20-mm antiaircraft cannons and other armament.

The Canadian Air Force

18010459g Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 31-39

[Article by Col V. Kondratyev]

[Text] Following the course of the NATO bloc, of which it is an active member, Canada devotes great attention to improving its armed forces, increasing their fighting power and raising the combat readiness of all components. In contrast to many other capitalist states, its armed forces are not divided into independent services—that is, into ground troops, air force and navy. They are based on six so-called functional commands—mobile, air force, navy, Canadian armed forces in Europe, training and communications. The first three perform the role of the corresponding armed services to a certain degree, but they do not have their own operational planning and control, rear and other forms of support, communications and personnel training organs inherent to the latter. The functions of all these organs are generally assigned in behalf of the armed forces to the joint national defense headquarters and two auxiliary commands—training (with some exceptions) and communications.

Within the framework of this unique unified structure of the Canadian armed forces, all units and subunits of the country's military aviation are brought together into the air force command. Information on the missions, organization, effective combat strength, personnel training, combat training of units and subunits and the prospects for this command's development is presented below on the basis of data published in the foreign press.

Missions, Organization and Effective Combat Strength

The air force command is the largest of all of the functional commands of the country's armed forces mentioned above. In particular its strength is over 37,000 personnel, of whom over 23,000 servicemen serve in the command's units and around 14,000 work in organs of the national defense headquarters, which deals with the problems of combat use and support of aviation, as well as in centrally subordinated units and subunits and in other commands. There are around 1,000 reservists in reserve units. The air force is armed with 675 airplanes and helicopters of 25 types. The command is intended to carry out the following missions: air defense of the most important military objectives and administrative and industrial centers; air support to ground forces and the navy, and air cover to these forces; transfer of personnel and cargo by air in behalf of the armed forces as a whole; air support to search and rescue operations carried out by state institutions and departments throughout the country's entire territory and contiguous areas of the Pacific, Atlantic and Arctic oceans, and independent conduct of such operations in its areas of responsibility.

Organizationally the air force command includes seven air groups, namely a fighter group, the 1st Canadian Air Group, naval aviation, the 10th Tactical Air Group, a transport air group, the 14th Training Air Group and a reserve group (officially called the reserve air group). In this case while the bulk of the forces of the six air groups are stationed on Canadian territory, the 1st Canadian Air Group has been transferred in its entirety to the 4th Joint Tactical Air Command of NATO's joint air forces in the Central European theater of military operations, and it is stationed in the FRG.

The fighter air group (headquarters in North Bay, Ontario) is the most significant air combat formation of the air force command in terms of armament and missions. It was created in June 1982 out of an antiaircraft air group. It is made up of the 416th, 425th and 441st fighter air squadrons (the first is armed with CF-5 fighters, see color insert [inserts not reproduced] while the other two are armed with CF- 18s, Figure 1 [figures not reproduced]), the 433d and 434th tactical fighter air squadrons (TFAS, CF-5 airplanes), the 410th and 419th combat training air squadrons (CF-18s and CF-5s respectively), and the 414th Electronic Warfare Squadron (CC-101s, CC-144s and others). The main airfields at which these subunits are based are Cold Lake (Alberta), Bagotville (Quebec), North Bay (Ontario) and Chatham (New Brunswick). There are a total of almost 170 combat and combat training airplanes in the group.

The commander of the fighter air group is administratively subordinated to the air force commander, while in operational respects concerning air defense issues he is subordinated to the commander of the resources of NORAD (North Airspace Defense System), a joint aerospace defense system of the North American continent. In the latter case he is simultaneously the chief of this system's 22d Region.

However, besides carrying out air defense missions, the fighter air group is given the responsibility of providing direct air support and air cover to units of the mobile command, and of cross-training flight crews to new types of airplanes and improving their combat training in support of both local combat air subunits and those deployed to West German territory.

The 1St Canadian Air Group (headquarters at Lahr Air Base in West Germany) is the air component of Canadian armed forces in Europe. Its main mission is to provide direct air support to the 4th Mechanized Brigade of the Canadian armed forces, stationed in West Germany, and when necessary, to ground forces units and subunits of other bloc members. The air group consists mainly of the best trained and manned tactical fighter subunits, namely the 409th, 421st and 439th TFAS, stationed at Baden-Zollingen Air Base and armed with CF-18 airplanes (eight aircraft in each). In addition the group includes a detachment of military transport aircraft from the 412th Transport Air Squadron (TAS), the main forces of which are based in Canada, and the 444th Helicopter Squadron (11 CH-136 Kiowa helicopters). This squadron carries out the missions of air reconnaissance, artillery fire adjustment, guidance of tactical fighters to ground targets by marking the latter with colored smoke and other means, and airlifting personnel and cargo. Both subunits are at Lahr Air Base.

The naval air group (Halifax, Nova Scotia) is operationally subordinated to the naval command, and therefore its combat training is organized and conducted in accordance with the interests and needs of naval forces. The group consists of squadrons of shore-based patrol airplanes—the 404th, 405th and 415th (CP-140 Aurora, Greenwood Air Base, Ontario), the 407th (CP-140, Comox, British Columbia) and the 880th Naval Reconnaissance Squadron (CP-121 Tracker, Summerside, Prince Edward Island); the 423d and 443d antisubmarine helicopter squadrons (CH-124 Sea King, Figure 2), and the 406th Combat Training Squadron (CH-124).

According to the Western press the group has the following basic missions: searching for and destroying the enemy's surface ships and submarines, patrolling the coastal zone and territorial waters of Canada, maintaining observation of the situation on the water surface and protecting national fishing grounds, and conducting

search and rescue operations. It is noted that the crews of the 404th, 405th, 415th and 880th AS [air squadrons] operate along the country's Atlantic coast, while the 407th AS operates on the Pacific coast. The principal missions—searching for and destroying surface ships and submarines—is assigned to air subunits armed with the most sophisticated CP-140 Aurora airplanes. This airplane (see color insert) is a modernized version of the American P-3C Orion. A total of 18 such aircraft were purchased for the Canadian armed forces; 16 of them are in the combat squadrons mentioned above, and two are in the naval testing air detachment at Greenwood Air Base.

The CP-121 Tracker airplanes in the group are to a significant extent obsolete, and they are used mainly to protect national fishing grounds, conduct search and rescue operations in coastal waters and train flight personnel for subunits armed with the CP-140.

Evaluating the combat capabilities of the naval air group, Lieutenant General L. Ashley, commander of the Canadian air force command, offers the following figures. Not less than five aircraft would be required to organize continuous tracking (for a day or more) of a single enemy submarine up to 1,600 km from an airfield used by shore-based patrol aviation, and the entire air group would be able to track only three submarines. Therefore in order for the group to carry out its mission of fighting submarines, the number of CP-140s in its composition must be doubled as a minimum.

The 10th Tactical Air Group (Saint Hubert, Quebec) represents the Canadian armed forces' army aviation. In operational respects it is subordinated to the commander of the mobile command (the group commander is the deputy commander for aviation). It is intended for the following combat missions: carrying out tactical airlifts of troops and cargo in the interests of units and subunits of the mobile command, providing fire support to them on the battlefield (on a limited scale), conducting air reconnaissance over the battlefield and at tactical depth, providing communication, and transporting patients and casualties.

There are six helicopter squadrons in the group. Three of them, armed with light CH-136 Kiowa helicopters and general-purpose CH-135 Twin Khyu [transliteration] helicopters, are assigned to specific brigades of the mobile command near which they are based; namely, the 408th AS (Edmonton, Alberta) is assigned to the 1st Motorized Infantry Brigade, the 427th AS (Petawawa, Ontario) is assigned to the 2d Airmobile Brigade, and the 430th AS (Valcartier, Quebec) is assigned to the 5th Motorized Infantry Brigade. Two squadrons (the 447th and 450th) are equipped with CH-147 Chinook tactical troop-lift helicopters that act in behalf of the mobile command. They carry personnel and various cargo. The last squadron (the 403d), the 6th, is a training squadron. It possesses helicopters of all types found in the other subunits. The group has a total of around 90 helicopters of various types.

The transport air group (Trenton, Ontario) is intended for the following basic missions: airlifting troops and cargo to remote theaters of military operations (in NATO operations—transporting personnel and materiel belonging to reinforcing subunits of the Canadian armed forces in Europe command); air-to-air refueling of warplanes; tactical airlifts of personnel, weapons and military equipment to theaters of military operations; organizing and leading search and rescue operations in the areas of responsibility of Trenton and Edmonton air bases, and providing air transportation support to such measures conducted by other departments and organizations in the other regions of the country's continental territory and water basins contiguous with it; transporting government VIPs.

The group contains 10 air squadrons (four transport, four transport and rescue, and two training), namely the 435th and 436th TAS (20 medium CC- 130 Hercules military transport aircraft, at Edmonton and Trenton air bases respectively), the 437th TAS (five CC-135 transport aircraft, two of which are equipped for use as air tankers, Trenton), the 412th TAS (CC-109 Cosmopolitan and CC-117 Falcon aircraft equipped for a higher passenger comfort), the 413th, 424th, 440th and 442d transport and rescue squadrons (CC-105 Buffalo and CC-138 Twin Otter airplanes and CH- 113 helicopters equipped for search and rescue operations, Comox, Summerside, Trenton and Edmonton air bases), the 426th Training Transport Air Squadron (three CC-130 airplanes, Trenton), and the 429th Special Training Air Squadron, equipped with transport airplanes (CC-130 and others).

The principal mission of the latter is to support the activities of the navigator training school of the 14th Training Air Group. At the same time its CC-130s regularly participate in all major exercises and transfers of troops and cargo according to plans of the higher command. The transport air group presently has a total of around 100 airplanes and helicopters.

The composition of the Canadian air force command is presented in greater detail in the table.

Composition of the Canadian Air Force Command

Air Group (Location of Headquarters)	Squadrons	Armament: Number of Airplanes (Helicopters), Type	Permanent Station
Fighter (North Bay, Ontario)	416th FAS	12 CF-5A	Chatham (New Brunswick)
	425th FAS	12 CF-18A Hornet	Bagotville (Quebec)
	441st FAS	12 CF-18A Hornet	Cold Lake (Alberta)
	433d TFAS[1]	12 CF-5A	Bagotville (Quebec)
	434th TFAS	16 CF-5A	Chatham (New Brunswick)
	410th Combat Training Air Squadron	27 CF-18A and B Hornet	Cold Lake (Alberta)
	419th Combat Training Air Squadron	22 CF-5A and B	"
1st Canadian (Lahr, FRG)	409th TFAS	18 CF-18A Hornet	Baden- Zollingen (FRG)
	421st TFAS	18 CF-18A Hornet	"
	439th TFAS	18 CF-18A Hornet	"
	444th AS	11 CH-136 Kiowa	Lahr (FRG)
	412th TAS (a detachment)	2 CC-142 Dash-8	"
Naval aviation	404th AS	4 CP-140 Aurora	Greenwood (Ontario)
	405th AS	4 CP-140 Aurora	"
	415th AS	4 CP-140 Aurora	"
	407th AS	4 CP-140 Aurora	Comox (British Columbia)
	880th Reconnaissance Air Squadron	10 CP-121 Tracker	Summerside (Prince Edward Island)
	423d AS	15 CH-124 Sea King	Shpruoter [transliteration] (Nova Scotia)
	443d AS	15 CH-124 Sea King	"
	406th Combat Training Air Squadron	8 CH-124 Sea King	"
	Naval testing detachment	2 CP-140 Aurora	Greenwood (Ontario)
10th Tactical (Saint Hubert, Quebec)	408th, 427th, 430th AS	A total of around 60 CH-136 Kiowa and CH-135 Twin Khyu	Edmonton (Alberta), Petawawa (Ontario), Valcartier (Quebec)
	447th, 450th AS	Total of 14 CH-147 Chinook and CH-135 Twin Khyu	Edmonton (Alberta), Ottawa (Quebec)
	403d Training Air Squadron	CH-135 and CH-136	Gagetown (New Brunswick)
	444th AS (a detachment)	5 CH-136 Kiowa	Ottawa (Quebec)
Transport (Trenton, Ontario)	435th TAS	10 CC-130 Hercules	Edmonton (Alberta)
	436th TAS	10 CC-130 Hercules	Trenton (Ontario)
	437th TAS	5 CC-135	Trenton (Ontario)
	412th TAS	16 CC-109 Cosmopolitan, CC-117 Falcon, CC-114 Challenger and CC-142 Dash-8	Ottawa (Quebec)
	413th, 424th, 440th, 442d AS	A total of 14 CC-115 Buffalo, 7 CC-138 Twin Otter, 11 CH-113A and B, CH-135	Comox (British Columbia), Summerside (Prince Edward Island), Trenton (Ontario), Edmonton (Alberta)
	426th AS	3 CC-130 Hercules and 7 airplanes of other types	Trenton (Ontario)
	429th AS	4 CC-130 Hercules	Toronto (Ontario)
14th Training (Winnipeg, Manitoba)	Central Flight School		Winnipeg (Manitoba)
	Flight School No 2	About 90 CT-114 Tutor	Moose Jaw (Saskatchewan)
	Flight School No 3: basic training squadron	20 CT-134 Musketeer-2	Portage-la-Prairie (Manitoba)
	Flight School No 3: helicopter pilot training squadron	15 CH- 139	
	Snowbird Squadron	10 CT-114 Tutor	Moose Jaw (Saskatchewan)
	Navigator Training School		Winnipeg (Manitoba)

Composition of the Canadian Air Force Command

Air Group (Location of Headquarters)	Squadrons	Armament: Number of Airplanes (Helicopters), Type	Permanent Station
	Search and rescue training squadron		Moose Jaw (Saskatchewan)
	Flight crew selection center		Toronto (Ontario)
Reserve air group (Winnipeg, Manitoba)	1st Reserve Air Wing[2]:		
	401st and 438th AS	10 CH-136 Kiowa	Montreal (Quebec)
	2d Reserve Air Wing:		
	400th and 411th AS	10 CH-136 Kiowa	Toronto (Ontario)
	402d TAS[3]	5 CC-129 Dakota	Winnipeg (Manitoba)
	418th TAS	5 CC-135 Twin Otter	Edmonton (Alberta)
	420th Patrol Squadron[4]		Summerside (Prince Edward Island)

The 14th Training Air Group concerns itself with training personnel for the country's armed forces. It includes a central flight school (training instructor pilots), and flight schools No 2 and No 3 (Moose Jaw, Saskatchewan and Portage-la-Prairie, Manitoba respectively), a navigator training school and a pilot candidate selection center (Toronto, Ontario). This group possesses a total of more than 170 airplanes and helicopters. Its fleet consists mainly of CT-114 Tutor jet trainers (see color insert) made in Canada (130 aircraft, including the 431st Snowbird Aerobatic and Demonstration Squadron, which falls within the group but is actually subordinated directly to the air force command). The group also contains CT-133A Musketeer propeller aircraft, CH-139 and CH-135 helicopters and other aviation equipment.

The reserve air group is the smallest unit of the Canadian air force command in terms of the number of airplanes and helicopters it possesses. It contains a few subunits intended for reinforcement of other air groups of the air force command in wartime. There are around 30 airplanes and helicopters in these subunits. An exception is the 420th reserve group air squadron, which does not have its own airplanes; its personnel train aboard CP-121 airplanes of the naval air group's 880th Squadron.

It is noted in the foreign press that the crews of the reserve air group have a rather high training level and participate regularly in exercises conducted by the air force command and by the armed forces as a whole, devoting up to 30 percent of their annual flying hours to this.

Personnel Training

According to the Western press the training command is responsible for training personnel for all functional commands. The air force command receives only ground specialists from the training command, while flight crews are trained by its own 14th Air Group.

Persons with the required level of general education and satisfying the health requirements of flying are permitted to train for flying occupations. Candidate pilots undergo a medical examination and psychological testing at the flight crew selection center. Persons who pass these tests are sent to an 11-week general military training course. After graduating from this course they receive their first military rank (lieutenant) and continue their training in Flight School No 3. Here for 20 weeks they study the theoretical principles of their future occupation and participate in a basic flight training course aboard piston-engined CT-134A Musketeer-2 trainers. In the first stage of the training (the average flying time per student is 25 hours) the instructors evaluate the capabilities of the students and make their final conclusions as to the suitability of their further training and their participation in flying. It is noted in the Western press that very stiff requirements are imposed on candidate pilots. Evidence of this can be found in the fact that up to 25-30 percent of students participating in the first stage of flight training are sifted out.

After completing the initial training course the future pilots are sent to Flight School No 2, where for 10.5 months they learn to fly the CT- 114 Tutor jet trainer, during which they master formation flying, instrument flying, piloting and the principles of combat use of onboard weapons in various conditions (the average flying time per student is 200 hours). The school's graduates receive the corresponding document awarding them the qualifications of a pilot, and a "wings" chest badge. Then depending on the needs of the air force and with regard for individual capabilities they are distributed among the combat training subunits for a course of basic and higher flight training in a particular specialty—fighter pilot, helicopter pilot or multiengine airplane pilot.

Pilots in fighter aviation spend this training stage in the 419th Combat Training Air Squadron aboard CF-5 airplanes. Their training course lasts 5.5 months, and it includes around 200 hours of ground training and 95 hours of flight training. Here they master the features of

piloting a supersonic fighter, and the tactics and principles of combat use of its onboard weapons against both ground and airborne targets. Then part of them are sent to air squadrons still equipped with CF-5 airplanes, while the rest end up in the 410th Combat Training Air Squadron for cross-training to the new CF-18 tactical fighters. Pilots from line units in combat aviation undergo cross-training here as well.

The CF-18 cross-training program includes 161 hours of ground training consisting of the following basic disciplines: piloting instruction aboard the CF-18 (69 hours), the APG-65 onboard radar station (14 hours), air-to-air weapons (the onboard cannon, AIM-7 Sparrow and AIM-9 Sidewinder guided missiles, 10 hours), the tactics of airborne target interception (12 hours), the tactics of close aerial combat (10 hours), instructions on combat use of weapons (31 hours), and use of electronic warfare equipment (15 hours). CT-133 and CC-117 airplanes from the 414th Air Squadron equipped with electronic warfare equipment are widely employed in addition to ground equipment in the last subject.

The flight training program used in CF-18 cross-training foresees mastery of piloting techniques and practice of all elements of combat use of the airplane in both simple and adverse weather. Each student is allocated 71.5 hours for this purpose: 43.8 hours for flying with an instructor aboard the two-seater CF-18B, and 27.7 hours in a one-seater CF-18A fighter. Much attention is devoted during the training to preliminary fulfillment of flying exercises using a ground trainer (the planned trainer use time is 35 hours per student).

It is reported in the foreign press that as a rule, 52 pilots (two groups of 26 each) undergo cross-training in the 410th Squadron each year. The cross-training program is organized in such a way that each student would have a possibility for flying 7.5 hours in the conditions of the Arctic winter. Moreover instructor pilot courses are organized at Cold Lake Air Base for units and combat aviation equipped with CF-18 fighters.

After completing their basic training course in Flight School No 2, multiengine pilots continue their training in the training squadrons of the naval and transport air groups (the 406th and 426th air squadrons respectively), and their flying skills aboard specific types of airplanes are perfected in the air force's combat subunits.

Helicopter pilots who complete their training in Flight School No 2 return to Flight School No 3, where they master CH-139 helicopters. Here for 5 months they undergo the corresponding ground training course and practical flight training (the average flying time is 70 hours per student). Then depending on their assignments they are sent to the 403d Training Squadron of the 10th Tactical Air Group or to helicopter subunits of the transport and naval air groups to learn how to fly the specific types of helicopters (that is, those which they are to fly in their subsequent career). The flying and tactical skills of helicopter crews are perfected in the air force's combat units and subunits.

Combat Training

The combat training of Canadian air forces is organized in accordance with the plans of the national armed forces command, and of the commands of NATO's joint air forces in Europe and the NORAD aerospace defense system of the North American continent. It is conducted in the form of daily combat training, as well as various sorts of exercises.

Concerning the latter, the foreign press notes that although the Canadian air forces occupy far from first place among the air forces of the NATO countries in terms of their size and combat capabilities, they do play an important role in NATO's war machine, and they are capable of carrying out a wide range of combat missions. Their units and subunits take an active part in many operations of the bloc's joint forces.

Thus the 1st Canadian Air Group is a constant participant of all exercises and maneuvers conducted by NATO's joint forces in the Central European theater of military operations. Air subunits of the Canadian air force regularly participate in exercises carried out on Norwegian territory to practice reinforcement of NATO's northern flank. Canadian air force fighter aviation participating in NORAD regularly exercises jointly with fighter units and subunits of the U.S. Air Force. Judging from reports in the foreign press, in addition to practicing interception of enemy airplanes and engaging them in aerial combat, the crews of Canadian fighters learn to hit cruise missiles as well. To practice this element of combat training, they are afforded a possibility for hunting and conditionally attacking air-launched American cruise missiles, which are regularly test-launched by the U.S. Air Force command over Canadian territory (the test range system at Cold Lake Air Base is the destination of the missiles). Airplanes and helicopters of the naval air group regularly train in missions to search for and destroy enemy submarines (both independently and in coordination with naval forces). Helicopter subunits of the 10th Air Group practice their actions in behalf of ground troops, and so on. Western military experts note that the crews of Canadian air force airplanes and helicopters are distinguished by a high training level.

Development

According to the foreign press the country's military leadership devotes constant attention to developing its armed forces, and chiefly the air force—the most mobile and effective component. With this purpose it conducts a number of measures, principal among them is improvement of the airplane fleet.

One of the principal measures in this regard is reequipping tactical fighter air subunits and air defense subunits with new American CF-18 Hornet airplanes. A total of 138 such fighters have been purchased for the air force. The last is to be delivered to the Canadian air force in September 1988, and eight squadrons equipped with CF-18s are to be combat ready by as early as 1989.

The "White Book on Canada's Defense Problems" examines the long-range 15-year plan for development of the country's armed forces. Further improvement of the airplane fleet is foreseen among other measures in its first stage (5 years). The following is to be done in this regard.

Another 12-20 CF-18 fighters are to be purchased (the air force commander believes that a significantly larger number of such airplanes would be required to carry out all of the missions posed to fighter aviation, with regard for replenishing possible losses).

The number of shore-based CP-140 Aurora patrol airplanes is to be increased. Six such aircraft have already been ordered (in the opinion of the air force command, another 12 need to be acquired).

The fleet of CC-130 Hercules military transport aircraft is to be increased from 28 to 45 units, and obsolete CC-109 Cosmopolitan and CC-115 Buffalo aircraft in the 412th and 413th transport air squadrons are to be replaced by the CC-130.

Replacement of French CC-117 Falcon light transport aircraft by new Canadian-made Challenger aircraft in the 412th and 414th transport air squadrons is to be completed.

Canada's own jet trainer is to be designed and adopted.

It is also emphasized that in order to reduce operating expenses, the number of types of airplanes and helicopters possessed by the air force must be reduced from 25 to 16.

Concurrently with replacing obsolete airplanes, there are plans for modernizing those still in the inventory. In particular 62, and possibly all 97 of the air force's CF-5 fighters (the latter figure includes aircraft stored in reserve) are to undergo repair. The main objective of this work is to increase the life of the airframe and its systems to 6,000 hours (they have presently used up almost all of their life—4,000 hours). In addition there are plans for modernizing CP-121 Trackers. They are to be repaired and equipped with turboprop engines and modern equipment (Figure 3).

There are plans for constantly improving new airplanes in the course of operation as well, including the CF-18 fighters.

In addition to the measures mentioned above, the organizational structure of air subunits and units and of the air force as a whole is being improved depending on redistribution of missions and introduction of new equipment. Thus, devoting great attention to its forward air group and the 1st Canadian Air Group in Western Europe, the command of the country's air forces has decided to reorganize the groups into an air division with the appropriate reinforcements in the course of mobilizational deployment, and to widen the range of its missions and all forms of support.

In the opinion of Canadian military experts, fulfillment of the measures named above, and a number of others, will make it possible to significantly expand the combat capabilities of the country's air forces, and thus make a contribution to increasing the fighting power of the NATO bloc's combined armed forces.

Footnotes

1. Cross-training to the CF-18

2. Operationally subordinated to the commander of the 10th Tactical Air Group

3. Operationally subordinated to the commander of the transport air group

4. Uses CP-121 Trackers of the 880th Reconnaissance Air Squadron

Aerospace Airplanes of the Future

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[Article by Prof V. Filippov]

[Text] The desire to constantly increase the combat capabilities of strategic offensive forces is one of the features of the military policy pursued today by the NATO leadership. In correspondence with this, the USA and a number of European members of the bloc (particularly Great Britain, France and the FRG) are conducting research on several long-range projects concerned with developing strategic attack aircraft, including hypersonic and aerospace transatmospheric airplanes of the future. It is believed that such aircraft should possess practically unlimited flying range, the possibility for taking off from airfields a few minutes after receiving orders, and reaching any remote target on the globe within a time not exceeding 1.5 hours. Moreover the capability of an aerospace airplane to change its orbital plane in the upper layers of the atmosphere or in near space would provide it significantly greater freedom of maneuver than any space system.

Research on the conceptions of hypersonic and transatmospheric aircraft has already been going on abroad for over 30 years, but because of serious technological and design difficulties, the feasibility of building them was doubted until the recent past. In 1983 the command of the U.S. Air Force proposed a plan for using space for military purposes foreseeing fulfillment of so-called antispace operations, blockades of the enemy's actions in space, and use of space-to-surface weapons. From this standpoint the aerospace airplane is viewed as a new class of supersonic combat aircraft intended for the following missions: placing nuclear or conventional weapons into orbit; deploying various forms of military equipment and the latest weapons (laser, beam etc.) in space; fulfilling reconnaissance missions and destroying space targets in low near-earth orbits; placing satellites and military space stations in orbit and servicing them, and delivering crews to the latter.

In the opinion of American military experts the unlimited basing of aerospace aircraft, the low probability of their interception by air defense weapons and the possibility for recalling them to base in the event that an attack order is rescinded provides them significant advantages over other systems of similar purpose. All of this significantly increases the interest in the conception of the aerospace airplane as a multipurpose system capable of playing a significant role both in "space surveillance" and in "use of force from space."

Creation of aerospace aircraft in most capitalist countries doing work in this area is associated with developing the technology of great hypersonic velocities (Mach 10-15 and higher), one of the key aspects of which is believed to be development of the corresponding propulsion units. Considering the complexity of the problem, the USA for example suggests solving it in two stages. In the first, the hypersonic technology as a whole (the aircraft, propulsion unit, structural materials, fuel) must be created, studied and evaluated, and in the second, the requirements on specific combat systems are to be developed and implemented.

The USA is presently pursuing hypersonic technology under the NASP (National Aerospace Plane) program, the results of which are to be used later on to create both aerospace airplanes and hypersonic airplanes. In particular preparations are being made for demonstration flight tests of the X-130 airplane with the goal of evaluating the possibilities of cruising flight in the atmosphere at hypersonic velocities.

While according to the plans aerospace airplanes will be piloted, a number of specialists feel that aerospace systems of the future should be unmanned. Thus aircraft could be controlled by automatic systems utilizing onboard computers employing elements of artificial intelligence. As far as plans for aerospace airplanes presently being drawn up are concerned, foreign specialists favor designing them in the manned version, owing to the need for satisfying the requirements of high readiness of these aircraft for fulfillment of various combat missions in limited time and for reassignment of targets while in flight.

It is believed that the combat capabilities of aerospace airplanes in regard to hitting ground and space targets will significantly exceed the capabilities of traditional aircraft systems—strategic bombers, fighters and missiles.

Judging from reports in the foreign press, the USA is conducting research on aerospace airplanes on the widest front. A certain amount of scientific and technical groundwork was laid here back in the 1960s during scientific research and design work and flight tests with experimental aircraft having a load-bearing hull. Thus the prototype of the American manned maneuverable aerospace airplane was the X-20 (1960-1963). The experimental X-24 program was carried out in 1966-1975 (research was conducted on the X-24A and B). These aircraft were suspended beneath the wing of a B-52, from which they were released to fly with operating liquid-fuel jet engines. A total of more than 60 flights were carried out. A speed corresponding to Mach 1.76 and an altitude of 22.6 km were attained. Many problems were studied during the flights, including the behavior of an aircraft with a load-bearing hull at different flying velocities, in critical operating conditions with working liquid-fuel jet engines, during horizontal landing on a landing strip, and others.

A number of theoretical and experimental studies have been carried out in recent years in wind tunnels. As a result, the aerodynamic characteristics of aircraft of the future were studied sufficiently well, and the range of conditions that must be met for transatmospheric flights was determined. The National Aeronautics and Space Agency (NASA) conducted a number of studies to evaluate the conditions of atmospheric reentry and determined the characteristics of aircraft with different shapes (with a hull of elliptical cross section and fins, with a blunt-nosed fuselage and so on).

A 0.015 scale model of the TAV (Transatmospheric Vehicle) aircraft was tested in 1984 in a hypersonic wind tunnel at the scientific research center in Langley (Figure 1 [figures not reproduced]). The conception of the TAV aerospace airplane was laid at the basis of a generation of hypersonic transatmospheric aircraft designed in the USA. The first stage of the TAV program, which was carried out in 1983, foresaw research on the preliminary conceptions of developing hypersonic aircraft by the U.S. Air Force and NASA, with the participation of several American firms. The aerospace firms proposed 14 variants of the aircraft design, of which six were selected for further research in the second stage. This stage was started in summer 1984 with the purpose of evaluating the effectiveness of military use of the TAV aerospace airplane, including in strikes on ground targets, reconnaissance and space surveillance. Research

was conducted concurrently in the most important areas of technology holding the key to creating hypersonic aircraft (new materials and engines, hypersonic aerodynamics, aircraft equipment and so on).

Analysis of the flight conditions of the TAV aerospace airplane revealed that owing to the unusually wide range of conditions, special requirements must be imposed on the structural strength of the aircraft, which must withstand high temperatures, possess sufficient operating life, require insignificant repair after flying, exhibit good controllability and require a short period of prelaunch preparation. Considering these requirements, promising metallic and composite materials possessing high strength (including at high temperature) and low specific weight are being considered as structural materials for the airframe. Heat-resistant "carbon-carbon" composite materials and ones containing an aluminum or magnesium alloy matrix and filamentous graphite crystals would most probably be used in the structure of aerospace airplanes.

Specialists at the scientific research center in Langley conducted a detailed analysis of the aerodynamic and weight characteristics of a number of design variants of aerospace airplanes selected for further study. A special computer system was used to calculate the probable aerodynamic and weight parameters of these variants of the aerospace airplane, including at supersonic and hypersonic flying speeds, with regard for friction. The calculations revealed that reducing the weight of the aerospace airplane's structure has special significance. Thus an increase in the weight of the aerospace airplane's structure by just one kg would mean a 10 kg increase in its takeoff weight.

An analysis of plans for a horizontal takeoff aerospace airplane established that in the launch phase such an aircraft would experience high loads, owing to which in the interests of strength it should have a heavier structure than that of similar vertically launched aerospace airplanes. At the same time with vertical launch a required bearing cannot be imparted to the aerospace airplane, and the launch complex would be a complicated and extremely expensive structure. A two-stage horizontal takeoff aircraft is believed to be one of the most advantageous conceptions of an aerospace airplane in both military and economic respects. The cost of such a system and the technical risk of its creation are the lowest, though the final estimates could be made only after further refinement of all of the requirements on combat use of an aerospace airplane.

In the opinion of foreign specialists design of the aerospace airplane's propulsion unit is the most important task, one which would in many ways determine the technical countenance of aerospace airplanes of the future. Various types of jet engines can be used depending on the flight conditions and the flight phases of the aerospace airplane, and the manner in which it is launched. Thus an air-breathing jet engine operating on conventional fuel at a negligible consumption rate is believed to be the most advantageous during atmospheric flight at Mach 3. As acceleration occurs and the flying speed climbs to a value corresponding to Mach 6, it would be suitable to use a ramjet engine and cryogenic fuel (liquid hydrogen or methane). Further growth of velocity may be achieved with a hypersonic ramjet engine, and injection of the aerospace airplane into orbit outside the atmosphere would be possible only by means of a rocket engine, for example a liquid-propellant rocket engine burning cryogenic propellant and liquid oxygen.

The reason why engines used in an aerospace airplane fall into the order indicated above are as follows: When an air-breathing jet engine operates at Mach 3, owing to aerodynamic heating and fuel combustion the gas temperature attains 1,560°C, which is the maximum value for operation of a turbine manufactured on the basis of contemporary technology; a ramjet engine does not have a turbine, but at Mach 6 the gas temperature climbs to 1,480°C just owing to the velocity head created by deceleration of air to subsonic velocity, and conventional fuel is unable to burn completely owing to the high speed at which the gases move (a fuel particle remains in the combustion chamber for less than 10 milliseconds).

Dependable operation of a ramjet engine requires the use of a fuel with a high rate of combustion—liquid hydrogen. However, its use in an aerospace airplane requires creation of new devices both in the engine (to gasify the fuel and deliver it to the combustion chamber) and in the airplane (to store the fuel in liquid state at low temperature).

Thus no conventional propulsion unit can effectively create the needed thrust in all phases of flight and in the entire range of flying speeds of an aerospace airplane. To achieve this goal, several engines must be used successively (air-breathing jet engine, ramjet engine, liquid-propellant rocket engine), or they need to be combined into a single propulsion unit. In both cases it would be suitable to optimize the operating conditions of the engines in relation to minimum fuel consumption.

For example it would be suitable to use a hypersonic ramjet engine during acceleration of an aerospace airplane at hypersonic velocity to Mach 25. Under these conditions such an engine equipped with variable-geometry intake and exhaust devices and operating on liquid hydrogen would consume the least fuel in comparison with other types of engines. Moreover hydrogen has a heat value that is approximately three times greater than that of fuel traditional to turbojet engines—JP-4 for example. At the same time the specific weight of hydrogen is a tenth of the weight of kerosene (0.8 kg/m^3 for liquid hydrogen and 780 kg/m^3 for JP-4), which means that its storage aboard the aerospace airplane would require a tank volume four times greater, even with regard for the high heat value of hydrogen.

But despite this, an aircraft equipped with a propulsion unit operating on liquid hydrogen and intended for atmospheric flight at Mach 6 would generally be lighter, the relative wing load would be lower and specific thrust would be higher than for an airplane equipped with engines burning traditional fuel. This conclusion is confirmed by the results of tests on the thrust characteristics of a hypersonic ramjet engine model in NASA's supersonic wind tunnel in conditions corresponding to a flying speed of Mach 4 at an altitude of 21 km, and of Mach 7 at an altitude of 33 km. The possibility of using liquid hydrogen to cool hot engine components using an aerodynamic-flow cooling system creating insignificant additional resistance was tested concurrently. Also, a proposal was made to use liquid hydrogen to cool the skin of the aerospace airplane's airframe during flight in order to reduce "temperature fatigue" of the structure and impart the necessary life to the aircraft's airframe. In the opinion of American military experts, use of a hypersonic ramjet engine in an aerospace airplane can decrease the cost of injecting 1 kg of payload into near-earth orbit to $220, as compared to $2,200 for the Shuttle spacecraft and $4,000-$9,000 for nonreusable launch vehicles (using prices effective in the first half of the 1980s).

America's Aerojet Corporation proposed the ATR (Advanced Turbo Ramjet) engine for the TAV aerospace airplane. This engine is a combination of an air-breathing jet engine, a ramjet engine and a liquid-propellant rocket engine. When operating in jet engine mode, the ATR engine generates a flying speed corresponding to Mach 3. As the speed increases, it goes over to combined operation. In this case air passes through the main loop of the air-breathing jet engine and is fed into the second loop—a ramjet engine equipped with an afterburner. When a velocity of Mach 6 is attained, the air channels close off, and the fuel and oxidizer are fed to the rear combustion chamber (operating as a liquid-propellant rocket engine). Combustion creates thrust allowing the aerospace airplane to climb and to fly outside the atmosphere.

It is believed that the ATR engine may become the means for creating the thrust required by aerospace airplanes of the immediate future. Development of a full-scale demonstration model of a combined engine (hypersonic ramjet engine burning hydrogen and a liquid-propellant rocket engine) being developed by a number of American companies under contract with the U.S. Air Force and NASA is being viewed as the next stage in creation of propulsion units for aerospace airplanes. A wind tunnel at Langley's research center is being modernized for this purpose. Its working part has a cross section of 2.4 m, and it can be used for full-scale engine tests at air current velocities attaining Mach 7.

It was announced by specialists of the U.S. Air Force that appearance of an experimental model of a combined engine for an aerospace airplane burning liquid hydrogen and using atmospheric air may be anticipated as early as in 1992-1993.

Besides problems associated with creating the propulsion unit for the aerospace airplane, there are also many difficulties in developing the aircraft itself, one capable of fulfilling its operational purpose and satisfying the prescribed weight characteristics. It was pointed out in 1983 in a report on plans being developed in the USA for the TAV that in order for the aircraft to raise a 9 ton payload, its takeoff weight would have to be within 450-680 tons in the case of horizontal takeoff and landing. This method of launching the aerospace airplane is a product of the basing requirements of reusable aircraft. Despite a number of shortcomings inherent to horizontal takeoff aerospace airplanes (higher launch weight and higher acceleration loads), such aircraft have a shorter "threat response time" (the time of prelaunch preparation is around 5 minutes), and they are capable of taking off in adverse weather, including in the presence of strong winds.

Moreover after they are injected into orbit, the aerodynamic qualities and fuel reserve of such aerospace airplanes allow them to reenter the atmosphere and return to orbit several times in a single flight. When conducting reconnaissance, an aerospace airplane could be placed into an orbit taking it over the target (which cannot be done with satellites); its range would be truly worldwide, and it would be capable of maneuvering extensively in the orbital plane.

In the estimation of foreign specialists, the following technical indicators can be achieved today with aerospace airplanes: ratio of the payload to the weight of the empty aircraft—0.25; flying time—up to 2 days; number of flights annually—40; total flights—500; time of operation—up to 15 years; flying time until preventive repairs—100 flights.

American military experts participating in development of the technical requirements on the TAV aerospace airplane assert that a one-stage hypersonic aircraft intended to fly on suborbital trajectories with a 9 ton payload may be created with a takeoff weight not exceeding 680 tons. When carrying out military missions, following a horizontal takeoff such a craft could assume an intermediate orbit (at an altitude of 80 km) in order to close in with the target, it could attack space targets at low near-earth orbits, it could enter the atmosphere (30 km) for ground strikes, and then it could once again climb to an orbit (150 km), and then return to base. A flight of one or two orbits would be sufficient for reconnaissance, and not more than 90 minutes would be required to hit a ground target. Lockheed has proposed an aerospace airplane satisfying these requirements. Its takeoff weight is 680 tons, its payload is 9 tons, its length is 62.5 m, the wingspan is 29 m, its height is 18.3 m, and it carries a crew of two. Besides orbital flight, such an aircraft would be capable of high altitude hypersonic flight.

Research is also being conducted on other variants of possible design and layout concepts for the aerospace airplane. Thus in 1985 associates of Langley's research

center analyzed 11 possible conceptions of aerospace airplanes capable of attaining a polar orbit at an altitude of around 300 km and returning a payload of 2.27 tons back to earth. These aerospace airplanes, which carry two cosmonauts, should be able to vary their speed in orbit by 60 m/sec, they should have a lateral range of 2,000 km, and they should be able to land on a landing strip 3,000 m long. The flying time of such aircraft is not less than a day, they could be used to repair satellites in orbit and to conduct rescue operations, they could operate from several air bases, and their operating cost should be low.

An analysis established that not one of the examined conceptions can fully satisfy all requirements. Therefore a decision was made to conduct research with the initial parameters altered somewhat. Thus the payload was increased to 4.54 tons, the payload compartment volume was increased to 56.6 m^3, and the increase in orbital velocity attained 550 m/sec.

As it turned out, two-stage aerospace airplanes capable of both vertical and horizontal takeoff satisfied these requirements the best. The takeoff weight and dry weight of the former are lower, it could be launched at any bearing, and its development involves lower technical risk. The horizontal takeoff craft is heavier, but it may be launched even if the orbital plane of the satellite is inconsistent with the launch point of the aerospace airplane, which is extremely important to reducing "response time."

Considering that orbit parameters (inclination, altitude, eccentricity), the location of the launch point, the maneuver required in orbit and so on impose many constraints on the aerospace airplane, because they must be accounted for strictly and because all cost and operating factors had to be evaluated in order to allow more careful analysis, a decision was made to prolong the research. In 1986 the USA announced a competition to create the most acceptable aerospace airplane design. The leading aerospace corporations—Boeing, General Dynamics, Lockheed, McDonnell Douglas and Rockwell—took part. Considering present technical accomplishments and creation of a number of new technologies, American specialists suggest the following possible timetable for creation of the aerospace airplane: Evaluation and design research on the aircraft and its propulsion would be completed in 1988, a flying model would be manufactured by 1992, and the first tests would be conducted by 1995.

Judging from reports in the foreign press, some NATO countries and Japan are also actively conducting research and design work aimed at creating transatmospheric aerospace airplanes.

Great Britain has now been conducting scientific research and design work for several years on development of the KhoTOL [transliteration] aerospace airplane. A model of the hypersonic aircraft was demonstrated in 1986 at the Farnborough Air Show. It is launched horizontally by means of a special launching trolley. This aerospace airplane, which has a takeoff weight of 200 tons, should be able to inject an 8 ton payload into an equatorial orbit 300 km in altitude. The length of the aircraft is 62 m, its wingspan is 19.7 m, the length of the payload compartment is 7.5 m, and the compartment's diameter is 4.6 m. The aerospace airplane is to be furnished with a combined engine, which will operate as an air-breathing jet engine for 9 minutes after takeoff, and then switch to liquid-propellant rocket engine mode on attaining a velocity of Mach 5 and an altitude of 25 km.

During atmospheric flight the engine should operate off liquid hydrogen and liquefied atmospheric air. Liquefaction is achieved by decelerating the air flow beneath the fuselage of the aircraft and directing it into a heat exchanger containing liquid hydrogen, in which the air is liquefied and separated into nitrogen and liquid oxygen. The nitrogen is released into the atmosphere to create additional thrust, and the oxygen, which passes through a turbopump unit, enters the engine's combustion chamber. Here it is burned together with hydrogen, thus providing a certain savings in oxidizer. Two or three low-thrust liquid-propellant rocket engines are installed on the aerospace airplane to permit maneuver while in orbit, and a special gas-jet system is used for orientation.

English specialists have determined the following sequence for the flight of the aerospace airplane carried out with the purpose of injecting it into equatorial orbit: horizontal takeoff from an airfield (the trolley running distance is 2,300 m, and the takeoff velocity is greater than 500 km/hr), attainment of supersonic speed after 2 min in climbing mode, and attainment of an altitude of 12 km after 4.5-5 min and an altitude of 25 km 9 min after launch, at a velocity of Mach 5. By this time, liquid oxygen consumption would be 18 percent of the aerospace airplane's takeoff weight. After delivery of atmospheric oxygen ceases, the aircraft switches to liquid-propellant rocket engine mode, and the subsequent gain in altitude is accomplished on a ballistic trajectory.

An orbital velocity of 7.9 km/sec is attained at an altitude of 90 km. In this case the main propulsion unit is shut down, and final injection of the aircraft into orbit is accomplished by means of the liquid- propellant rocket engine in the orbital maneuvering system. The time of orbital flight of the aerospace airplane can attain 50 hours. A braking impulse is imparted to end the flight. The aircraft falls out of orbit, drops to an altitude of 70 km at an 80° angle of attack, and then continues to descend while gradually reducing its angle of attack. At an altitude of 25 km it begins its glide phase for the landing.

According to calculations made by English specialists the KhoTOL aerospace airplane will possess a rather high lift/drag ratio (4.5 at supersonic velocity and 6.5 at subsonic velocity), which is almost twice greater than for the Shuttle spacecraft. Owing to this, the aerospace

airplane has a greater lateral range, allowing it to land in Western Europe after flying an equatorial orbit. The velocity of the landing approach is 460 km/hr with the propulsion unit shut off. An aerodynamic brake turns on for 9 sec to reduce speed during initial leveling. Gliding flight occurs at a velocity of 420 km/hr, which gradually decreases, equalling 315-350 km/hr by the moment of touchdown. The landing run of the aerospace airplane is 1,800 m. It is believed that the life of the KhoTOL aerospace airplane (the airframe life) would be 120 flights. Flight tests with the experimental model of the craft are expected to begin in 1996.

In the **FRG**, Messerschmitt-Bolkow-Blohm has proposed its own design of an aerospace airplane, the Zenger, as an alternative to the KhoTOL (Figure 2). It should be a two-stage aircraft consisting of a hypersonic mother aircraft and the Khorus [transliteration] orbiting stage with a payload of 16 tons. The mother aircraft (51.8 m long, 24.9 m wingspan), which has a takeoff weight of about 500 tons and is equipped with a turbo ramjet engine, should take off horizontally with a conventional jet engine and deliver the Khorus stage to an altitude of 30-35 km with cosmonauts (from two to six persons) and cargo aboard. The orbiting stage has a launch weight of 50 tons (24.9 m long, 12.2 m wingspan), and it is equipped with a propulsion unit containing a liquid-propellant rocket engine generating a thrust of 54.4 tons and operating off of cryogenic propellant. The Khorus stage should separate from the mother aircraft at a velocity corresponding to Mach 6 and then attain an orbit with an altitude of 300 km. In the opinion of West German specialists the Zenger aerospace airplane may be ready for operation by the year 2004.

In **France**, intensive research is being conducted with the purpose of creating an aerospace airplane. It is directed at developing a two-stage vertical launched aerospace airplane employing an Ariane-5 launch vehicle.

There are plans for placing the Hermes aerospace airplane (weight 9-11 tons) into near-earth orbit at an altitude of 400 km and an inclination of 28.5°. Its payload is 5.5 tons in the unmanned variant and 4.5 tons when manned by a crew of four to six. The length of the craft is 17.9 m, it is 5.1 m high, the span of the delta wing is 10.2 m, and the area of the payload cross section is 35 m^2. Together with the load-bearing hull, the wings of the aerospace airplane, which have a 74° sweepback and vanes on their wingtips (Figure 3), should allow maneuver with a lateral range of 2,500 km, and horizontal landing on an airfield. The cabin of the Hermes aerospace airplane (volume 26 m^3) is fashioned after the cabin of an A-320 passenger airplane. The crew will receive basic information on flight parameters from five displays showing the orbit indicators, navigation data, and information on the work of various aircraft systems and on the aircraft's trajectory.

The aerospace airplane is to be built over a period of 9 years, and flight tests are to begin in 1994. Six test flights using the mother aircraft are to be conducted initially, after that, two orbital flights are to be made, and then operation of the aerospace airplane is to begin in 1996 (two flights annually until the year 2004, and three or four flights annually after that). The life of the aerospace airplane should be 30 flights.

In **Japan**, work on aerospace airplanes is presently proceeding only in the form of scientific research. Thus specialists of an aeronautical and space research institute are studying the possibility of creating the HIMES (Highly Maneuverable Experimental Space Vehicle) aerospace airplane capable of injecting a 0.5 ton payload into an orbit with an altitude of 300 km. This craft should be launched vertically by a launch vehicle. The takeoff weight of the aerospace airplane is 14.1 tons, its length is 13.7 m, and its wingspan is 9.14 m. The propulsion unit consists of two liquid-propellant rocket engines operating off of oxygen-hydrogen propellant. They can support an orbiting time of 900- 1,100 sec, and they are capable of decelerating and returning the aircraft to the launch-and-landing complex. The rate of descent was selected at 1,000 m/sec, which would make it possible to avoid creating special heat protection for the airplane, inasmuch as heating of its structure would not be excessive in this case. Japanese specialists are also studying the possibility of creating a large horizontal takeoff and landing aerospace airplane (with a takeoff weight of 350 tons, a length of 77 m and a wingspan of 35 m) with a combined propulsion unit (hypersonic ramjet engine and liquid-propellant rocket engine). In addition research is being conducted on development of new materials, thermal protection for the aircraft, and engines.

It is noted in the foreign press that one of the priority tasks associated with creating aerospace airplanes as a new form of military equipment is that of developing a propulsion unit capable of generating the thrust needed by the aerospace airplane both during takeoff and acceleration in the atmosphere, and during injection into near-earth orbit, deceleration, descent and landing. Considering that such a propulsion unit would not be able to operate with traditional fuel, the problem of using a new form of fuel needs to be solved concurrently, and a way to store it aboard the aircraft must be found.

Inasmuch as the work of the propulsion unit of an aerospace airplane is most intimately associated with the design of the aircraft itself (the behavior of the air flow within the engine's gas-dynamic loop depends entirely on interference by the airframe and the propulsion unit), in the opinion of foreign specialists the second most important task is to create an aircraft structure of the required configuration that is sufficiently strong, light and long-lasting in the face of intense heating. This will require the use of the latest composite materials, which should possess high heat resistance and strength in the face of polycyclic loads.

Foreign experts believe that the scientific and technical advances that have been made thus far in the fundamental and applied sciences and development of progressive

technologies make it possible to assert with sufficient certainty that the basic problems associated with creating a new generation of hypersonic and aerospace airplanes may be solved within the next 10-15 years.

Surface Forces of the U.S. Navy

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[Article by Capt 1st Rank V. Chertanov]

[Text] In the structure of the American navy, which numbers almost 600 ships, surface forces are the most numerous and heterogeneous component, intended for the performance of a complex of combat and support missions in operations of U.S. and NATO naval forces in ocean and sea theaters of military operations. They contain practically all categories of the U.S. Navy's fleet forces except submarines and aircraft carriers, and namely surface warships, amphibious warfare, mine warfare and small missile ships, auxiliary vessels providing mobile rear and combat support, landing craft, and special-purpose patrol boats.

The U.S. Navy's surface forces number 400 ships and vessels (Table 1). In addition the regular fleet contains 170 combatant craft (119 landing craft, 44 special-purpose craft, 7 minesweepers), and the emergency reserve contains 71 special-purpose craft. Over a third of the vessels of the surface forces are ships and vessels of new design.

Table 1. Ships of the U.S. Navy's Surface Forces

Categories, Classes and Subclasses of Ships and Vessels	Atlantic Fleet	Pacific Fleet	Total
1	2	3	4
Regular Navy			
Surface warships of the principal classes:	105	97	202
—Battleships	1	2	3
—Guided missile cruisers	16	20	36
—Including atomic cruisers	4	5	9
—Guided missile destroyers	23	14	37
—Destroyers	16	15	31
—Guided missile frigates	24	19	43
—Frigates	25	27	52
Amphibious warfare ships:	31	32	63
—General-purpose	2	3	5
—Helicopter	4	3	7
—Amphibious transport docks	7	8	15
—Dock landing ships	6	5	11
—Tank landing ships	9	9	18
—Cargo ships	2	3	5
—Amphibious command ships	1	1	2
Mine warfare ships	4	-	4
Small missile ships	6	-	6
Total	146	129	275
Auxiliary vessels			
Underway replenishment ships	18	19	37
—Transporters	10	13	23
—Oilers	8	6	14
Fleet support and service	25	16	41
—Tenders	14	7	21
—Rescue vessels	9	7	16
—Repair ships	2	2	4
Other special vessels	1	2	3
—Training aircraft carriers	1	-	1
—Experimental	-	2	2
Total	44	37	81
Total in the regular navy	190	168	356
Emergency Reserve			
Surface warships of the principal classes	12	9	21
—Destroyers	1	-	1
—Guided missile frigates	7	6	13
--Frigates	4	3	7
Tank landing ships	1	1	2
Mine warfare ships	9	9	18
Auxiliary vessels	1	2	3
Total	23	21	44
Total in surface forces	213	187	400

Table 1. Ships of the U.S. Navy's Surface Forces
Categories, Classes and Subclasses of Ships and Vessels Atlantic Fleet Pacific Fleet Total

Surface warships are the most significant and numerous category of surface forces. They include ships of the following classes: battleships, cruisers, destroyers and frigates. They are intended for participation in combat missions with the purpose of attaining supremacy in ocean and sea theaters of military operations in both offensive and defensive operations.

In providing antiaircraft, antisubmarine and antiship defense as part of carrier and missile ship strike groups, amphibious assault landing groups, underway replenishment groups or convoys, surface warships perform chiefly defensive (escort) functions, and when they use Tomahawk cruise missiles and Harpoon antiship missiles, they participate in strikes on sea and land targets—that is, they carry out offensive (strike) missions. The American navy's demand for ships of these classes has remained stable for many years, and plans foresee fleet forces totaling four battleships, up to 54 guided missile cruisers, 37-47 guided missile destroyers, 32-37 destroyers and 100-110 frigates—that is, a total of over 250 units. This level is to be attained not only by building new ships but also by modernizing and lengthening the operating life of some ships in the battleship, cruiser and destroyer classes.

Battleships were reintroduced into the active navy beginning in 1982, during fulfillment of a program to modernize "Iowa" class battleships built in 1943-1944, which were formerly in the naval reserve (in the mothball fleet). The battleships "New Jersey" (Figure 1 [not

reproduced]), "Iowa" and "Missouri" have been introduced into the force composition thus far. Modernization of the last ship of this class—the "Wisconsin"—is being completed in 1988.

The program for de-mothballing and modernizing battleships foresaw removal of 4 of 10 127-mm twin artillery mounts, installation of 8 shielded four-tube Tomahawk cruise missile launchers, 4 four-tube Harpoon antiship missile launchers, and 4 Vulcan-Phalanx antiaircraft artillery systems, replacement of radio observation, reconnaissance and electronic warfare systems, improvement of propulsion units and improvement of the habitability of ship compartments. Modernization has increased the life of battleships to 15-20 years—that is, until the beginning of the next century.

Combat use of battleships is foreseen within missile ship strike groups jointly with cruisers, destroyers and frigates capable of providing dependable antiaircraft and antisubmarine defense and armed with Tomahawk cruise missiles and Harpoon antiship missiles. In the opinion of American military specialists deployment of such groups in the forward areas of ocean theaters would significantly supplement the offensive capabilities of naval force groupings against sea and land targets, widen the possibilities for fire support to amphibious assault landings, including with the use of the main guns (nine 406-mm guns in three turret mounts), and somewhat reduce the burden of aircraft carriers during combat. In different situations the missile strike groups may operate both independently and in coordination with carrier battle groups, where carrier aviation would be used for air cover or to organize a combined missile and air strike in an operation conducted in a theater of military operations.

Cruisers are represented by a single subclass in the regular American navy—guided missile cruisers. There are a total of 36 ships, including nine nuclear-powered ("Long Beach," "Bainbridge," "Truxtun," four "Virginia" class and two "California" class, Figure 2 [not reproduced]), and 27 with gas turbine propulsion units (nine "Ticonderoga" class, Figure 3 [not reproduced]) and steam propulsion units (nine each of "Leahy" and "Belknap" classes). Except for the "Long Beach" nuclear- powered guided missile cruiser, which is a specially built ship, all of them were reclassified in 1975 as guided missile frigates. The latest cruisers of the "Ticonderoga" class were initially designed as guided missile destroyers. Then in 1980 (following rejection of plans for a new nuclear-powered attack cruiser by Congress, and rejection of further construction of "Virginia" class nuclear-powered guided missile cruisers), a decision was made to build lighter cruisers with a conventional propulsion unit using the hull of the "Spruance" class destroyer as the basis, equipped with the most sophisticated weapons—the Aegis dual-purpose weapon system, the Harpoon antiship missile and the Tomahawk cruise missile. "Ticonderoga" class guided missile cruisers began entering the navy's composition in 1983, and 27 such ships are to be built by 1995.

Guided missile cruisers, being the largest surface ships after battleships (with a displacement from 8,000 to 17,000 tons), make up the basis of the security forces of carrier battle groups and other operational forces and groups of the navy. They possess powerful antiaircraft missiles (Standard surface-to-air guided missiles of various modifications, with a basic unit of fire of 60-120 missiles), Harpoon antiship missiles (four four-tube launchers, eight missiles), ASROC antiship guided missiles (eight missiles), two triple torpedo launchers, one or two 127-mm artillery mounts (except on "Leahy" and "Bainbridge" class guided missile cruisers), and two 20-mm Vulcan- Phalanx antiaircraft artillery systems. ASW helicopters may be launched from their decks. Ships of the "Virginia" class and the "Long Beach" guided missile cruiser are also armed with Tomahawk cruise missiles (two four-tube shielded launchers). Beginning with the sixth ship of the series, "Ticonderoga" class guided missile cruisers are able to fire Tomahawk cruise missiles, Standard surface-to-air missiles and ASROC antiship guided missiles using an Mk41 vertical launcher. The unit of fire of Tomahawk cruise missiles aboard these ships (there are presently five of them) is up to 24 units. A total of 22 "Ticonderoga" class cruisers are to be armed with these missiles.

Because of the growing demand for providing combat security to carrier and ship strike groups, the USA has deemed it suitable to lengthen the operating life (30 years) of "Leahy" and "Belknap" guided missile cruisers and the "Long Beach," the "Bainbridge" and the "Truxtun," built in 1961-1967, by 5-10 years by modernizing them in the course of routine overhaul. They will remain in the regular navy until 1996-2007. The qunatity of guided missile cruisers in the regular navy will grow as "Ticonderoga" class ships are built, and it may attain 54 units by 1995.

In order to provide security to nuclear-powered aircraft carriers, the number of which may be eight or nine units by the end of the century, the possibilities of designing a new maneuverable, high-speed guided missile cruiser with a combined (nuclear-powered and gas turbine) propulsion unit is being studied.

Destoyers are represented by two subclasses in the regular fleet: guided missile destroyers of three classes—"Kidd" (4), "Coontz" (10) and "Charles F. Adams" (23), and "Spruance" class destroyers (31). The naval reserve contains three guided missile destroyers and 11 "Sherman"/"Hall" class destroyers, with the "Edson" in the emergency reserve.

Guided missile destroyers possess effective antiaircraft missiles (68 Standard-ER surface-to-air guided missiles aboard "Kidd" class guided missile destroyers, 40 Standard-ER surface-to-air guided missiles aboard "Coontz" class guided missile destroyers, and 40-42 Standard-MR surface- to-air guided missile aboard "Charles F. Adams" class guided missile destroyers), Harpoon antiship missiles (two four-tube launchers or in a basic unit of fire together with a surface-to-air missile system aboard "Charles F. Adams" class ships), ASROC antisubmarine guided missiles (eight launcher rails), two

324-mm triple torpedo tubes, one or two 127-mm artillery mounts and two 20-mm Vulcan-Phalanx antiaircraft artillery systems (only aboard "Kidd" class guided missile destroyers). As with guided missile cruisers, they are intended predominantly for air defense of ship formations and groups. "Coontz" class guided missile destroyers were reclassified in 1975 as guided missile frigates; their antiaircraft armament was modernized. Three "Charles F. Adams" class ships (DDG19, 20 and 22) also underwent modernization in 1981-1985 with the purpose of lengthening their operating life by 15 years (beyond their 30 years of service). Plans for similar modernization of the rest of the ships of this class were examined and tabled as being economically unfeasible.

"Spruance" class destroyers (built 1975-1983), which are general-purpose warships, were oriented to a greater degree on antisubmarine missions within the composition of security forces of the navy's operational formations and groups. The missile, artillery and antisubmarine armament of these ships is similar to that possessed by guided missile destroyers. However, in contrast to guided missile ships, the antiaircraft armament is represented by Sea Sparrow close-range surface- to-air missile systems (eight launcher rails, 24 missiles) and two Vulcan-Phalanx antiaircraft artillery systems. The antisubmarine warfare possibilities of destroyers were increased by basing two SH-60B Sea Hawk multipurpose helicopters on them carrying the Mk3 LAMPS system. To strengthen the striking capabilities of these ships (against sea and land targets), a decision was made later on to arm them with Tomahawk cruise missiles. Today seven destroyers are armed with two four-tube shielded launchers for cruise missiles of this type (DD974, 976, 979, 983, 984, 989 and 990) and two (DD963 and 991) are equipped with Mk41 vertical launchers (61 launcher rails for Tomahawk cruise missiles and ASROC antisubmarine guided missiles). There are plans for supplying the other 22 ships of this class with such launchers, which are installed at the bow of the ship in place of the Sea Sparrow surface-to-air missile systems and ASROC launchers. Thus "Spruance" class destroyers are the first ships of this class in the U.S. Navy armed with medium-range cruise missiles, and to go beyond the framework of purely antisubmarine warfare missions.

A program to build 29 guided missile destroyers of a new class—"Orli Berk" [transliteration]—was initiated in the USA to compensate for the forthcoming retirement of "Coontz" and "Charles F. Adams" class ships from the navy's active forces when their service life expires. The lead ship is to be commissioned in 1989. This destroyer, which has a total displacement of 8,300 tons, will be the first in the USA in the postwar era to have a steel superstructure bearing armor over the most vulnerable points. The ship is armed mainly with an Mk41 mod 2 vertical launcher with 90 launcher rails (29 at the bow and 61 at the stern) for Standard surface-to-air guided missiles, Tomahawk cruise missiles and ASROC antisubmarine guided missiles. In terms of the rest of the missile, artillery and torpedo armament they are similar to other ships of this class. Hangars for ASW helicopters such as on "Spruance" class destroyers are not foreseen, though a landing pad is to be set up on deck.

Despite the fact that judging from the foreign press the demand for ships of this class is significantly greater than what is presently available, there are no plans yet to continue construction of "Orli Berk" and "Spruance" class ships. "Sherman"/"Hall" class destroyers in the reserve are ill suited for reinforcement of the fleet's active forces, and in the near future they will be retired from the navy.

Frigates are the most numerous class of surface warships in the American navy, intended chiefly for antisubmarine protection of the navy's operational formations and groups. There are 43 guided missile frigates in the regular navy, (37 "Oliver H. Perry" and 6 "Brooke" class), and 52 frigates (39 "Knox," 10 "Garcia," 2 "Bronstein" and "Glover"). There are 13 "Oliver H. Perry" class guided missile frigates and 7 "Knox" class frigates in the navy's emergency reserve.

"Oliver H. Perry" class guided missile frigates have been under construction in the USA since 1975. Fifty ships have been transferred to the navy thus far (in addition, four were built at American building docks for the Australian navy). Construction of the last ships is expected to be completed by late 1988. They are armed with two Mk3 LAMPS system helicopters, a general-purpose Mk13 mod 4 launcher for Standard surface-to-air guided missiles and Harpoon antiship missiles (an ammunition load of 40 missiles), a 76-mm artillery mount and a 20-mm Vulcan-Phalanx antiaircraft artillery system, two 324-mm triple torpedo launchers and a sonar station equipped with a TACTAS system AN/SQR-19 long towed antenna. Presence of Standard surface-to-air guided missiles and the Vulcan-Phalanx antiaircraft artillery system makes it possible for guided missile frigates of this class to provide air defense to underway replenishment groups, assault landing detachments and convoys (in addition to carrying out antisubmarine missions).

Guided missile frigates of the "Brooke" class built in 1964-1967 are armed with an Mk1 LAMPS system Seasprite SH-2F helicopter, an Mk22 Tartar launcher (surface-to-air missiles, an ammunition load of 16 missiles), four single-tube torpedo launchers and a 127-mm artillery mount. Thirty-one frigates of this type were equipped with Sea Sparrow surface-to-air guided missile launchers, which are presently replacing Vulcan-Phalanx antiaircraft artillery systems on all ships.

"Garcia" class frigates (1964-1968) are also reclassified escort destroyers. Their dimensions are similar to "Brooke" class guided missile frigates, and their armament differs only in the presence of a second 127-mm caliber artillery mount in place of a surface-to-air missile launcher. "Bronstein" class frigates (1963), which have a

somewhat lower displacement, do not possess a helicopter hangar or a twin 76-mm caliber artillery mount. The "Glover" (1965), which had been used for a long time as an experimental ship, was reclassified as a frigate in 1979. Its armament is similar to that aboard "Brooke" class ships, except for the surface-to-air missile launcher.

In the estimation of foreign military specialists the number of frigates in the U.S. Navy somewhat exceeds the minimum necessary level for convoy escort and for protection of underway replenishment groups. Therefore in view of limitations on allocations for the maintenance and construction of the fleet, a decision was made in fiscal years 1988-1989 to retire 16 ships from the navy early: six "Brooke" class guided missile frigates and 10 "Garcia" class frigates. In addition three "Oliver H. Perry" class guided missile frigates and one "Knox" class frigate are to be transferred into the emergency reserve in 1988 in accordance with its acquisition plan, and two "Oliver H. Perry" class guided missile frigates are to be transferred in 1990. By 1991 the U.S. Navy's emergency reserve is to contain 26 frigates, including 18 "Oliver H. Perry" class and 8 "Knox" class. Construction of ships of this class on the basis of new designs is presently not foreseen in the USA.

Amphibious warfare ships are designed to transfer marine infantry formations and units by sea and to land them on an unprepared enemy coast. The American navy contains 63 amphibious warfare ships of the regular fleet and 11 reserve ships represented by six classes: amphibious assault ships (12), amphibious transport docks (15), tank landing ships (23, including 2 in the emergency reserve and 3 in the mothball fleet), dock landing ships (16, including 5 in the mothball fleet), amphibious cargo ships (6, including 1 in the mothball fleet) and amphibious command ships (2).

Amphibious assault ships are represented by "Tarawa" class general-purpose amphibious warfare ships (five units were built in 1976-1980) and "Iwo Jima" class amphibious assault ships (seven, 1961-1970). They can carry a larger number of troops (up to a battalion of marine infantry), and besides landing craft they carry 25-30 troop-lift helicopters in combination with vertical or short takeoff and landing airplanes.

Further development of ships of this class is associated with construction of five new "Wasp" class amphibious assault ships. They are designed on the basis of the "Tarawa" class general-purpose amphibious warfare ships, but their characteristics are better: While possessing the same displacement (around 40,000 tons), they can carry up to 40 helicopters and Harrier airplanes, as well as three LCAC air- cushion landing craft in place of one. Artillery armament will consist only of three 20-mm Vulcan-Phalanx antiaircraft artillery systems. Construction of the lead ship is to be completed in 1989, and of the entire series by the mid-1990s. Construction of another seven ships of this class, which will replace the navy's "Iwo Jima" class amphibious assault ships, is to be financed in the future.

Amphibious transport docks, which are represented in the navy by the "Raleigh" class (three units, built 1962-1964) and "Austin" class (12, 1965-1971), combine the possibilities of troop and cargo transporters, and they can carry both up to 930 Marines and around 2,000 tons of military cargo, wheeled equipment and landing craft, and 6 troop-lift helicopters. The ships are armed with two twin 76-mm artillery mounts and two 20-mm Vulcan-Phalanx artillery systems. Two of them (the "La Salle" and the "Coronado") were refitted and are now being used as command ships (by the commanders of U.S. Armed Forces in the Middle East and the Third Fleet). One of the "Raleigh" class ships (the "Vancouver") is to be transferred to the emergency reserve by 1992.

Dock landing ships are intended chiefly to transport various types of landing craft. The regular navy possesses 11 ships of this class: three "Thomaston" class (and in addition, five in reserve, built 1954- 1957), five "Anchorage" class (1969-1972) and three of the most recent class, "Whidbey Island" (Figure 4 [not reproduced]), construction of which has been going on since 1981. Five ships of this class are in different stages of construction. They will replace the remaining "Thomaston" class ships. The ship building program for 1988-1992 foresees construction of another five ships of this class, but in the cargo variant. A total of six such dock landing ships are planned. Ships of this class can carry 300-500 infantry and up to 28 heavy landing craft, including four air-cushion landing craft. The ships are armed with two 20-mm Vulcan-Phalanx antiaircraft artillery systems or three twin 76-mm artillery mounts.

Tank landing ships are designed to carry a Marine assault force and its heavy ground equipment to an assault landing area. There are 20 "Newport" class ships in the navy (built 1969-1972), two of which are in the emergency reserve. They can carry up to 400 Marines and various equipment (up to 29 tanks, or 29 amphibious armored personnel carriers, or up to 70 trucks). The assault force is unloaded at a pier or on an unprepared coast. Ships are armed with two 76-mm twin artillery mounts, which are to be replaced by two Vulcan-Phalanx antiaircraft artillery mounts (there is one such mount on LST 1179, 1180, 1181, 1188, 1192, 1194 and 1197). Three "Desoto County" class tank landing ships are also in the reserve (in the mothball fleet). Construction of new ships of this class in the USA is not as yet foreseen.

Five amphibious cargo ships remain in the regular American navy ("Charleston" class, built 1968-1970), and one ("Tulare" class) is in the reserve. All of them are presently listed as being in the inventory of the regular navy,

though four of them were placed into the emergency reserve for the period from 1979 to 1983. The ships are intended to convey troops, combat equipment and various cargo, and they are outfitted with high-capacity cargo handling devices for fast unloading into landing craft from both sides simultaneously. They can carry up to 225 Marines. The armament of the ships consists of three twin 76-mm artillery mounts (there are two such mounts and two Vulcan-Phalanx antiaircraft artillery systems aboard the LKA117 "El Paso").

Amphibious command ships are used as the flagships of amphibious assault groups, formations and operating fleets. The U.S. Navy has two "Blue Ridge" class ships. The "Mount Whitney" is presently the flagship of the Second Fleet, while the "Blue Ridge" is the flagship of the Seventh Fleet. The ships are equipped with the appropriate observation, reconnaissance and communication systems, and they can accommodate—besides the staff of the operational fleet (up to 170 persons)—the staff of an amphibious squadron or an amphibious assault group (over 70) and the staff of an expeditionary Marine formation.

The armament of the ships consists of two Sea Sparrow surface-to-air missile launchers, two twin 76-mm artillery mounts and two 20-mm Vulcan- Phalanx antiaircraft artillery systems.

Construction of new classes of amphibious warfare ships foreseen by the USA's ship building program will make it possible to increase their number to 74 units, raise the effectiveness and assault force capacity of amphibious forces, and thus ensure simultaneous transfer of a Marine expeditionary division and brigade. The overall capabilities of amphibious warfare ships as of 1997 are shown in Table 2, which was compiled on the basis of data in American publications.

Table 2. Overall Capabilities of Amphibious Forces of the U.S. Navy as of 1997

Class, Type of Ship, Year Introduced into Force Composition	Quantity	Troop Capacity, x1,000	Cargo Capacity, x1,000 Registered Tons	Quantity of Landing Resources	
				Helicopters	LCAC Launches
General-purpose amphibious warfare ships					
—LHD1 "Wasp", 1989-1996	5	9.3	5.0	210	15
—LHA1 "Tarawa", 1976-1980	5	8.5	5.38	190	5
Amphibious assault ships					
—LPH2 "Iwo Jima", 1961-1970	7	14.0	2.76	189	-
Amphibious transport docks					
—LPD4 "Austin", 1965-1971	11	8.5	4.25	44	11
Dock landing ships					
—LSD41 "Whidbey Island", 1985-1990	8	4.0	0.395	-	32
—LSD49 "Whidbey Island" (cargo variant), 1985- 1994	6	2.7	2.4	-	12
—LSD36 "Anchorage", 1969-1972	5	1.5	0.07	-	15
Tank landing ships					
—LST1179 "Newport", 1969-1972	20	8.0	0.645	-	-
Amphibious cargo ships					
—LKA113 "Charleston", 1968-1970	5	1.0	3.4	-	-
Amphibious command ships					
—LCC19 "Blue Ridge", 1970-1971	2	0.3	-	-	-
Total	74	57.8	24.3	633	90

Mine warfare ships of the U.S. Navy are represented by 21 ocean minesweepers (19 "Aggressive" class built 1954-1956, and two "Acme" class, built 1957-1958) and by one mine countermeasures ship of a new design, the "Avenger." The regular fleet presently contains three "Aggressive" class ocean minesweepers ("Illusive," "Leader," "Fidelity"), one "Avenger" class ship and seven minesweeping launches. All other mine warfare ships are in the navy's emergency reserve. Ships of obsolete classes may be used predominantly along the east and west coast of the USA. However, because of growing tension in the Middle East, it was recently deemed suitable to use six "Aggressive" class ships in the Persian Gulf to protect tankers escorted under the American flag from mines.

To heighten the combat capabilities of the sea component of the U.S. Navy's mine warfare forces (the air component is represented by three minesweeping helicopter squadrons), in addition to building 14 "Avenger" class mine warfare ships (prior to 1991), which are to replace obsolete minesweepers, the USA also planned to build 17 "Cardinal" class coastal mine warfare ships in the early 1980s. But in view of the design's imperfections, it was abandoned, and a decision was made in 1987 to build mine warfare ships of similar purpose on the basis of an Italian design ("Lerichi" [transliteration]). A five-year program (1988-1992) foresees allocating funds for construction of 12 such ships in addition to the lead ship (MHC51), financed by prior allocations. Plans are presently being made to build a sum total of 27

new mine warfare ships, of which 24 are to be transferred to the navy's emergency reserve as ships of old classes are replaced.

"Pegasus" class **small missile ships** are a new class of low- displacement (up to 265 tons total displacement) hydrofoil patrol ships in the U.S. Navy. At the time that they were designed, construction of a series of 30 units was initially planned. However, the growing cost of construction and budget constraints reduced the series to six ships, which were transferred to the fleet in the period from 1977 to 1982. Ships armed with Harpoon antiship missiles (two four-tube launchers) and a 76-mm artillery mount are capable of high speed (up to 50 knots) and a rather long cruising range (over 600 nautical miles at a speed of 40 knots on hydrofoils, and 1,225 nautical miles at 11 knots in conventional mode).

Operating within a specially formed squadron (Key West, Florida), these ships are being used effectively to patrol and maintain surveillance on marine lines of communication in the Gulf of Mexico, the Strait of Florida and the Caribbean Sea, and for reconnaissance by the shores of Cuba and Nicaragua.

Auxiliary vessels of the U.S. Navy carry out an entire complex of combat and rear support and service missions in behalf of the naval forces in the course of the different variants of their combat activities and daily routine. Depending on purpose, they are divided into three major categories—underway replenishment ships, fleet support ships and combat support ships.

Underway replenishment ships are intended for replenishment at sea of the reserves of fuel, food, supplies and equipment of warships operating within operational fleets far away from naval bases and stations. Fifty-seven vessels of the regular fleet and of the Military Sealift Command are used for these purposes.

Ammunition ships (AE) are represented by vessels of the "Kilauea" class (eight units, built 1968-1972) and "Suribachi" class (five, 1956-1959). Ammunition ships are equipped with special equipment by which to transfer cargo to ships, and with helicopter pads and hangars ("Kilauea") for two UH-46 Sea Knight transport helicopters, and they are armed with two 76-mm twin artillery mounts and two 20-mm Vulcan-Phalanx antiaircraft artillery systems ("Kilauea"). In 1980 the lead ship, the "Kilauea," was transferred to the Military Sealift Command, but it is still being used by the navy for its intended purpose. There are plans to finance construction of five ammunition ships of a new design in 1991-1994 to replace obsolete "Suribachi" class vessels.

"Sacramento" class fast combat support ships (AOE) (four units, built 1964-1970) are the world's largest vessels (total displacement 53,600 tons), intended to replenish fuel, ammunition and food reserves. Their cargo capacity allows them to convey around 30,850 m^3 of fuel, 2,100 tons of ammunition and 250 tons of food. The vessels are outfitted with equipment for vertical replenishment, and they possess a hangar for two transport helicopters. Their armament includes a Sea Sparrow surface-to-air missile launcher and two Vulcan-Phalanx antiaircraft artillery systems. The ship building program foresees construction of another four such transporters.

Store ships (AFS, T-AFS, T-AF) are represented by "Mars" class vessels (seven) in the regular navy, built 1963-1970, and by a "Rigel" class vessel and three "Sirius" class transporters (T-AFS), acquired in Great Britain, in the Military Sealift Command. They are all capable of conveying about 4,000 tons of various cargo. "Mars" class vessels are armed with two 20-mm Vulcan-Phalanx antiaircraft artillery systems.

Oilers (AO, T-AO, AOR) are intended chiefly to convey all types of fuel. The regular navy possesses oilers of the "Cimarron" (five, built 1981- 1983), "Wichita" (seven, 1969-1976) and "Ashtabula" classes (two, 1945). In addition "Neosho" (six) and "Mispillion" class (five) oilers from the Military Sealift Command and oilers of a new class, "Henry Kaiser" (four), are permanently used in behalf of the navy, including within forward forces. All oilers are capable of carrying from 20,000 to 30,000 tons of fuel, while "Wichita" class vessels can also carry up to 600 tons of ammunition, 100 tons of food and 200 tons of other dry cargo. Vessels of the regular navy are armed with 20-mm Vulcan-Phalanx antiaircraft artillery systems or 76-mm twin artillery mounts ("Ashtabula" class), while "Wichita" class vessels additionally carry a Sea Sparrow surface-to-air missile launcher. There are plans for continuing construction of "Henry Kaiser" class oilers for the Military Sealift Command at a rate of two vessels per year. There are to be a total of 21 such oilers.

Fleet support ships include destroyer (AD) and submarine (AS) tenders and repair ships (AR).

"Samuel Gompers" (two, built 1967-1968), "Yellowstone" (four, 1980-1983) and "Dixie" (three, 1940-1944) class destroyer tenders are high- displacement vessels (up to 20,000 tons) intended to provide full service to surface ships. They are equipped with high-capacity cranes, helicopter platforms or hangars, repair shops and storage compartments, and they can operate in the areas of both rear and forward bases and naval stations. The "Puget Sound" tender has been used in the last 5 years as the flagship of the U.S. Sixth Fleet on the Mediterranean Sea. The vessels are armed with up to four 20-mm single antiaircraft artillery mounts.

"L. Y. Spear" (two, built 1970-1971), "Emory S. Land" (three, 1979- 1981), "Simon Lake" (two, 1962-1968), "Hunley" (two, 1962-1965) and "Fulton" (three, 1941-1945) class submarine tenders are intended to provide full services to submarines and restore their combat capabilities between cruises. Four tenders ("Simon Lake" and "Hunley" class) are specially designed to service nuclear-powered submarines, while the rest service multipurpose submarines. "Emory S. Land" class tenders are specialized to service "Los Angeles" submarines. All vessels of this class are equipped with cranes, helicopter platforms and numerous shops.

The tender "Orion" is registered at the forward base of La Maddalena (Italy), and it is used permanently in the Mediterranean Sea within the U.S. Sixth Fleet. The tender "Proteus," which serviced Polaris nuclear missile submarines for 20 years, is registered at the naval base on Guam (Marianas Islands), and since 1981 it has been supporting ships and submarines of the Seventh Fleet.

"Vulcan" class repair ships (four, 1941-1944) operate regularly within the composition of the U.S. Navy's forward groupings, and they carry out all forms of current repairs on ship equipment and weapons. Formerly a repair ship, the ARL24 "Sphinx" is now being used as a reconnaissance ship by the shores of Central America.

Combat support ships include rescue vessels, tugs, sonar reconnaissance vessels, experimental vessels, nuclear missile submarine tender supply ships, cable ships and the training aircraft carrier "Lexington."

Rescue vessels are represented in the navy by three subclasses: "Safeguard" (four, 1985-1986) and "Bolster" (seven, with three in the emergency reserve, 1944-1946) class salvage ships (ARS), "Pigeon" (two, 1973) and "Chanticleer" (four, 1943-1947) class submarine rescue ships (ASR) and "Edenton" class salvage tugs (ATS) (three, 1971-1972). All are capable of diving and ship-raising jobs, rescue operations, including with the use of deep-sea submersibles, and towing of damaged vessels and ships.

"Cherokee" class (five) fleet tugs (ATF, T-ATF) are in the naval reserve, and "Powhatan" class fleet tugs (seven, built 1979-1981) are in the Military Sealift Command. The vessels are equipped with towing devices, cranes, winches, pumps and other rescue equipment.

"Stalwart" class long-range sonar surveillance vessels (T-AGOS) of the Military Sealift Command are a new class of fleet combat support vessels. They are specially designed to collect information on the underwater situation in forward areas by means of the SURTASS towed sonar system, and to transmit this information to centers on shore for analysis and evaluation in combination with data from the SOSUS stationary long-range sonar surveillance system. Vessels of this class have been under construction in the USA since 1983. Nine such vessels have been transferred to the navy thus far, and there are plans to build a total of 28 by the mid-1990s, of which the last nine will be catamarans.

The following vessels are in the same category: three "Victory" and "Vega" class store ships (T-AK) in the Military Sealift Command, which have been refitted out of merchant vessels to carry ballistic missiles, torpedoes and POL with which to replenish the reserves of nuclear missile submarine tenders; the "Dolphin" experimental submarine (AGSS), "Norton Sound" missile system testing vessels (AVM), "Point Loma" [transliteration] deep-sea research vessels (AGDS), and the training aircraft carrier "Lexington," used to train the crews of carrier-based aircraft; three vessels of the Military Sealift Command ("Neptune" and "Zeus" classes) intended for submarine cable laying and repair.

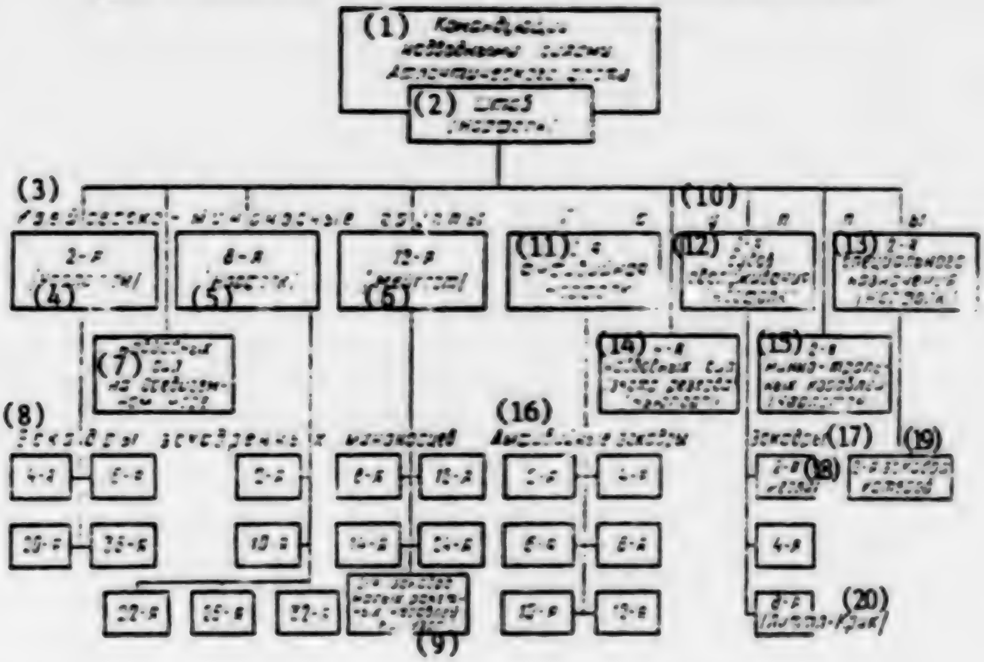
Organizationally the surface ships and auxiliary vessels of the regular navy and the emergency reserve fall into two major formations of surface forces of the USA's Atlantic and Pacific fleets. These major formations (with vice admirals as their commanders) were created in the second half of the 1970s out of the homogeneous commands of fleet cruiser, destroyer, amphibious, mine warfare and service forces, as well as coastal and river combat commands existing prior to 1975. They include all of the categories of ships and vessels listed above. The headquarters of the surface forces of the Atlantic and Pacific fleets are located at the naval bases in Norfolk (Virginia) and Coronado (California) respectively.

The principal tactical formations of fleet surface forces are groups (surface forces, cruiser-destroyer, amphibious, mine warfare, service ship, special purpose) and squadrons (destroyer amphibious, service ship, small missile ship, special-purpose launch). A group is a tactical formation above the squadron level (group commanders are rear admirals, and squadron commanders are captains). As a rule squadrons are included in groups.

The surface forces of the Atlantic Fleet (Figure 5) include: three cruiser-destroyer groups (the 2d, 8th and 12th) with their headquarters at Charleston (South Carolina), Norfolk and Mayport (Florida) respectively, the group of surface forces in the Mediterranean Sea, the 4th Surface Forces Group (emergency reserve ships) headquartered in Newport (Rhode Island), the 2d Amphibious Group (headquartered in Norfolk), the 2d Mine Warfare Group (Charleston), the 2d Service Ship Group (Norfolk) and the 2d Special Purpose Group (Norfolk). Each cruiser-destroyer group contains several guided missile cruisers (the "Iowa" battleship is also in the 8th Group) and four or five destroyers, including 12-18 ships of the destroyer-frigate class (as with the group of surface forces in the Mediterranean Sea, the 14th, 20th, 22d, 24th, 26d, 32d and 36th squadrons do not have a permanent composition). The 4th Surface Forces Group contains up to 13 ships of the emergency reserve. The 2d Amphibious Group is organized into six amphibious squadrons, of which four (the 2d, 4th, 6th and 8th) do not possess permanently registered ships, and two (the 10th and the 12th) contain from 14 to 18 amphibious warfare ships.

The 2d Support Ship Group contains three squadrons of ships (5-11 in each), while the 2d Minesweeper Group consists of regular-navy ocean minesweepers and minesweeping launches (up to 11 units). The 2d Special Purpose Launch Squadron, which is in the 2d Special Purpose Group, contains 30-40 launches (regular navy and emergency reserve).

Figure 5. Administrative Organization of the Atlantic Fleet's Surface Forces



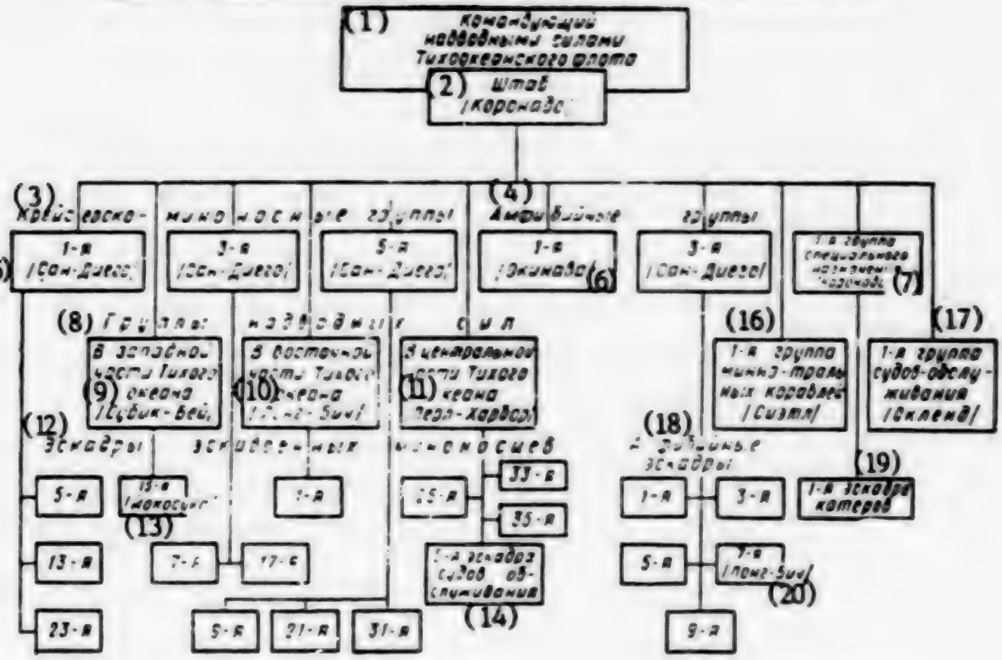
Key:
1. Commander, surface forces, Atlantic Fleet
2. Headquarters (Norfolk)
3. Cruiser-destroyer groups
4. Charleston
5. Norfolk
6. Mayport
7. Mediterranean Sea surface forces
8. Destroyer squadrons
9. 2d Small Missile Ship Squadron (Key West)
10. Groups
11. 2d Amphibious (Norfolk)
12. 2d Support Ship (Norfolk)
13. 2d Special Purpose (Norfolk)
14. 4th Surface Forces (emergency reserve) (Newport)
15. 2d Mine Warfare (Charleston)
16. Amphibious squadrons
17. Squadrons
18. Iyerly [transliteration]
19. 2d Launch Squadron
20. Little Creek

The surface forces of the Pacific Fleet (Figure 6) consist of the following tactical formations: surface forces groups in the western, central and eastern parts of the Pacific Ocean (headquartered at Subic Bay, the Philippines, Pearl Harbor, the Hawaiian Islands, and Long Beach, California respectively), three cruiser-destroyer groups (the 1st, 3d and 5th, all registered at San Diego, California), two amphibious groups (the 1st and 3d with their headquarters at White Beach, Okinawa and San Diego, California), the 1st Support Ship Group (Oakland, California), the 1st Minesweeper Group (Seattle) and the 1st Special Purpose Group (San Diego). The surface forces groups and the cruiser-destroyer groups contain destroyers (up to three squadrons) and guided missile cruisers. Two battleships and a surface forces squadron containing up to 10 emergency reserve ships are registered to the surface forces group in the Eastern Pacific. The 1st Amphibious Group and the 3d Amphibious Group's 1st, 3d and 5th squadrons do not have a permanent composition. The standard composition of other types of groups and squadrons is the same as for the corresponding formations of the Atlantic Fleet.

In a combat or combat training situation, surface forces of the tactical formations (existing in the fleet's administrative organization) are operationally subordinated to the commanders of task groups of the Second, Third, Sixth and Seventh fleets or other operational force elements.

In the estimation of U.S. naval specialists, the goal of building and developing the surface forces of the fleets is to permit deployment, in the case of war, of up to 15 carrier and 4 missile ship strike forces and assault task forces capable of transferring up to three Marine expeditionary brigades and up to 10 underway replenishment groups to the landing area, and of escorting seven large ocean convoys.

Figure 6. Administrative Organization of the Pacific Fleet's Surface Forces



Key:
1. Commander, Pacific Fleet's surface forces
2. Headquarters (Coronado)
3. Cruiser-destroyer groups
4. Amphibious groups
5. San Diego
6. Okinawa
7. 1st Special-Purpose Group (Coronado)
8. Surface forces groups
9. In the Western Pacific (Subic Bay)
10. In the Eastern Pacific (Long Beach)
11. In the Central Pacific (Pearl Harbor)
12. Destroyer squadrons
13. Yokosuka
14. 5th Support Ship Squadron
16. 1st Mine Warfare Ship Group (Seattle)
17. 1st Support Ship Group (Oakland)
18. Amphibious squadrons
19. 1st Launch Squadron
20. Long Beach

Acoustic Protection for Nuclear-Powered Submarines of the U.S. Navy

18010459j Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 57-60

[Article by Capt 1st Rank V. Parkhomenko, doctor of technical sciences, and Capt 1st Rank Yu. Pelevin]

[Text] In their efforts to increase their military power, capitalist countries are devoting significant attention to the navy, and especially to nuclear-powered submarines (fleet ballistic missile submarines and nuclear-powered attack submarines), which have become the main strike force of the navies of the principal imperialist states in NATO. Consequently work is being done to increase their combat capabilities, effectiveness and safety. Such work foresees, in particular, diversified research in acoustics, hydrodynamics and magnetism.

The main tactical property of a submarine—undetectability—decreases significantly with growth of the noise it emits. Despite the fact that the U.S. Navy allocates hundreds of millions of dollars to the development of various submarine detection equipment, nothing other than sonar equipment has yet been found that can detect submarines over a significant distance (several dozen kilometers). This is why the problems of acoustic protection are so important to construction of modern nuclear-powered submarines and development of submarines of the future. Specialists of the U.S. Navy were able to continually decrease submarine noise in recent decades. This became possible owing to implementation of a number of special measures concerned with acoustic protection of nuclear-powered submarines. A decrease in the noise level of submarines need not compromise their advantages. Thus if necessary, the required acoustic characteristics may be attained in the American navy by reducing other important tactical characteristics, including maximum speed, unsinkability, the viability of the nuclear propulsion unit and the weight and size characteristics of vibrating machinery. The maximum submerged speed of American fleet ballistic missile submarines is within 21-25 knots. The reserve buoyancy of modern single-hull submarines of the U.S. Navy is 9-13 percent; these submarines have a single-reactor, single-shaft propulsion unit with a relative weight of 35-40 kg/horsepower.

Another typical feature of the U.S. Navy is that the most important technical concepts concerned with reducing the noise level of nuclear- powered submarines are tested out aboard specially designed experimental submarines. The first nuclear-powered submarine used to test the turbine-electric drive system was the SSN597 "Tulibee" (built 1960), and later on this system was perfected aboard the submarine SSN685 "Glenard P. Lipscomb" (1974). The lowest noise levels were attained with it (close to the minimum), but nonetheless American military specialists do not feel that it would be suitable to recommend its wide introduction until comprehensive research is completed in support of transition to totally electric drive. The preference toward turbogear main propulsion units is explained in particular by the fact that a turbine-electric drive somewhat increases the displacement and decreases maximum speed (the weight and size characteristics of nuclear propulsion units equipped with turbine-electric drive can apparently be reduced by utilizing superconductivity phenomena).

The advantage of nuclear-powered submarines with turbine-electric drive in terms of noise characteristics cannot be doubted, according to Western experts, but for the moment nuclear propulsion units equipped with turbine-electric drive have been installed only aboard the two experimental craft mentioned above, and the deep-sea experimental submarine NR1. Propulsion units for nuclear-powered submarines with partial (auxiliary) electric drive capable of silent running have become widespread. Such nuclear propulsion units are installed in practically all modern submarines of the U.S. Navy, and chiefly "Los Angeles" class nuclear-powered attack submarines and "Ohio" class missile submarines.

It is noted in the foreign press that one of the key problems in reducing the noise level of submarines is that of eliminating the main circulating pumps of nuclear reactors from the machinery installed to reduce the noise level of a traveling submarine. This could be done by creating conditions for natural circulation of the reactor coolant in the reactor's first loop. However, under these conditions it would be impossible to increase the reactor coolant's circulation rate in the event of an abrupt temperature increase in the reactor core, which can result in its impermissible overheating. To exclude overheating, coolant pumps are turned on in low-noise nuclear-powered submarines with the purpose of accelerating the movement of the reactor coolant in the first loop only when an abrupt increase in reactor output is required (for example in the case of an emergency increase in the submarine's speed). The natural circulation reactor was installed for the first time aboard the nuclear-powered attack submarine SSN671 "Narwhal," built 1969. Later on such a natural coolant circulation system was used aboard "Ohio" class fleet ballistic missile submarines. This was one very important means by which very low noise levels were arrived at in these submarines. Tests on a straight turbine (without a main turbogear propulsion unit) aboard the American submarine SSN605 "Jack," "Permit" class, built 1967, was one attempt to reduce the noise level of nuclear-powered attack submarines.

In the opinion of foreign specialists, creation of low-noise submarines would require emphasis on their acoustic signature beginning with the earliest design stages. As far as the noise generated by the submarines themselves is concerned, it is determined by architecture, by the propulsion units and by internal power production equipment (machinery).

American nuclear-powered submarines are single-hulled for the greater part of their length. The outer hull, which covers only the bow, the stern and the missile compartment, imparts a hydrodynamically smooth surface to the submarine in the area of the main ballast tank and the part of the missile shafts that extends above the cylindrical part of the pressure hull. Deviation of the outlines of nuclear-powered submarines from axisymmetrical shape is minimal, owing chiefly to the small size of the missiles, upon which rigid requirements were imposed during development. In this case a hull length/diameter ratio from 9 to 12 is believed to be optimum. The outer hull is conical at the stern, and it blends in smoothly with the pressure hull. At the bow it is once again an axisymmetrical but blunt, rounded nose.

The pressure hull of American nuclear-powered submarines is welded out of cylindrical, tapered and elliptical sections, the circular cross section of which ensures maximum strength. Frames are installed along the entire length of the hull, against the inner surface of the plating. Additional strength is imparted to the hull by flat transverse bulkheads separating it into watertight compartments ("Los Angeles" class nuclear-powered attack submarines have three compartments, while "Ohio" class fleet ballistic missile submarines have four).

The U.S. Navy devotes considerable attention to work on low-noise propulsive devices for submarines. Besides multiple-bladed screw propellers of special profile, shrouded propellers and various types of water-jet propellers are being examined as low-noise propulsive devices for submarines. Foreign military specialists feel that the pump-type water-jet propellers designed in Great Britain and installed aboard "Trafalgar" class nuclear-powered attack submarines are characterized by the lowest noise level. There are plans for installing them into American "Seawolf" class submarines of the future.

Seven-bladed large-diameter low-noise propellers are employed as propulsive devices on most modern nuclear-powered submarines of the U.S. Navy. A single-shaft low rpm mechanical system, a single-hull axisymmetrical architecture and a specially designed after fin assembly also help to minimize blade noise and exclude cavitation within a wide range of submarine speeds.

Considering that noise created by water flowing around the hull and protruding parts and noise generated by the propeller is hydrodynamic in nature, their dimensions have been minimized aboard modern nuclear- powered submarines in order to reduce this noise. Additionally, parts of the mooring system are made removable and retractable into the outer hull. Even the quality of welded seams and the condition of paint or surface coatings on the hull have an influence on the level of hydrodynamic noise at high speed. This is why minimizing even the slightest surface roughness (for example by special mastics) is one of the important measures implemented to reduce the noise level of submarines.

Given implementation of the measures mentioned above, because the architecture of American nuclear-powered submarines is the way it is, the level of hydrodynamic noise generated by streamlining of the hull is significantly lower than the noise of screw propellers and machinery at low speed.

During silent running, submarine machinery (pumps, turbines, turbogenerators, reduction gears) is the principal source of noise covering a wide frequency range. Prior to the 1960s the noise level of submarines was reduced mainly by making machinery (sound sources) noiseless. This was done by implementing design measures, by optimizing kinematics, by improving the precision of installation and assembly of individual parts and units, by increasing the symmetry of the structure's thermal signature and rigidity, by achieving an optimum ratio between the weight of the stator and the rotor, by reducing the rpm of revolving parts and the rate of flow of working media, and so on. Subsequently, machinery is constantly monitored and adjusted in order to minimize vibration during its operation. Specialists of the U.S. Navy developed an automated system for precision balancing of the revolving parts of nuclear propulsion units. The system makes it possible to determine the adjustments to be made in one or several parts to achieve precision balance of a steam-turbine unit, to select the optimum variant and to automatically monitor the precision balancing process, and to calculate the nature of balancing weights and the places they are to be mounted on revolving units of the nuclear propulsion unit.

Further progress in reducing the noise level of atomic submarines is also associated today with vibration isolation and vibration damping (that is, with structural means of acoustic protection), and not with reducing the noise level of the sound sources themselves. Attention is being focused in this case on creating a balanced system of acoustic protection encompassing all sound sources and paths by which oscillating energy is transmitted into the external environment.

Besides using other structural means of reducing the noise level of machinery, American specialists are striving to reduce the natural oscillation frequency of vibration isolators, to utilize vibration isolators with variable frequency characteristics, and to employ the largest possible quantity of vibration damping equipment. Shock- absorbing fasteners with a natural oscillation frequency of up to 5 Hz were installed as long ago as in "George Washington" class fleet ballistic missile submarines. According to information in the foreign press, the natural oscillation frequency of the lowest-frequency ship suspension systems (isolators) is presently around 2 Hz. Creation of various shock absorbers with adjustable frequency characteristics (pneumatic, hydraulic, magnetic and others) has also been reported. A system for adjustment of the rigidity of the shock absorbers of missile launchers was used aboard American fleet ballistic missile submarines back in the 1960s. Adjustments were made by changing (using a magnetic field) the viscosity of the working medium of the shock absorbers, which consists of a mixture of iron shavings and a silicon fluid. Before missiles are launched, in order to stabilize the shafts relative to the hull the rigidity of the shock absorbers is increased by applying the highest electric current to the magnetic coils of the shock absorbers, as a result of which the working mixture of the shock absorbers, which initially has a fluid consistency, acquires the properties of potter's clay, and the shock absorbers themselves become practically rigid. American specialists feel that when vibration isolating and vibration damping resources are combined in order to reduce the noise level of power production equipment, vibration dampers may attain 20-30 percent of the weight of the noiseproofed machinery.

In order to prevent the spread of vibration and noise from the steam turbine unit aboard the American fleet ballistic missile submarine "Ethan Allen" (built 1961), its principal mechanisms were moved to a special platform. Later on a shock absorber-equipped platform began to be used aboard English "Swiftsure" nuclear-powered submarines to install the reduction gear, the turbines, the turbogenerators and other machinery. This is why the noise level of these nuclear-powered submarines turned out to be lower than what was proposed in the plan. It is noted in the foreign press that introduction of shock absorber- equipped platforms not only requires solution of a number of strength problems, but it also involves considerable material outlays and brings about the need for considerable space. Prior to the introduction of shock absorber-equipped platforms, noise emission by the power production equipment of nuclear-powered submarines was decreased mainly by noiseproofing the machinery (the sound sources); a weakly pronounced dependence was observed between reduction of integral noise levels[1] in response to growth of displacement. With wide use of structural means of acoustic protection, noticeable reduction of the noise level of nuclear-powered submarines was accompanied by an increase in their displacement. It was reported that when the noise level of "Los Angeles" class submarines was decreased to 122 dB in comparison with 138 dB for "Sturgeon" class submarines, their submerged displacement increased by almost a factor of 1.5 (from 4,640 to 6,900 tons). The "Ohio" class fleet ballistic missile submarine has an average integral noise level of 102 dB (with a submerged

displacement of 18,700 tons), as compared to 134 dB for a "Lafayette" class submarine (8,250 tons).

A tendency for noticeable reduction of the integral noise level associated with transition to construction of new series of ships is a general law for American submarines. In this case the noise level of submarines decreased as new series were built. For example integral noise levels were decreased by 5 dB during construction of a series of "Sturgeon" class nuclear-powered submarines (1967-1975), by 4 dB during construction of "Los Angeles" class series (1975-1981), and by 6 dB during construction of "Ohio" class fleet ballistic missile submarines (1980-1988).

The U.S. Navy has assumed a differentiated approach to developing the requirements on the noise level of different classes of submarines. Requirements imposed on fleet ballistic missile submarines are more rigid than on multipurpose nuclear-powered submarines, which is what is responsible for the difference in their noise levels at comparable speeds.

The following features are typical of the design of acoustic protection of nuclear-powered submarines of the U.S. Navy:

—much attention is being devoted to reducing air-transmitted noise in compartments that adds to the hydroacoustic field. For this purpose special sound-absorbing coatings are employed in addition to various absorbers of air-transmitted noise. These coatings are applied to hull structures inside submarines. Interference (active) methods of absorbing air-transmitted noise are also employed;

—technological achievements in acoustic protection of submarines are freely exchanged between NATO partners, mutual deliveries of equipment and apparatus for vibroacoustic measurements are made, and acoustic test ranges are created and operated jointly;

—sizable specific allocations for work to reduce the noise level of submarines are combined with direct material stimulation of companies and their specialists participating in solving this problem. In particular during examination of the design of the "Seawolf" class nuclear-powered submarine, priority attention was devoted to the effect of air-transmitted noise in compartments on the hydroacoustic field. In this case allocations totaling tens of millions of dollars were foreseen in the new program of research on the interconnection between air- transmitted noise and emitted submarine noise. There are plans for reducing the average integral noise level of these submarines to 115 dB (when silent running at around 20 knots);

—an integrated approach is being taken to applying noiseproofing resources and methods to nuclear-powered submarines.

Introduction of some technological solutions into "Ohio" class fleet ballistic missile submarines may serve as an example of an integrated approach to the problems of acoustic protection: a single-hull axisymmetrical architecture; a single-shaft nuclear propulsion unit with a low rpm (around 100) propeller of greater diameter bearing blades of a special shape, and low-noise load-adjustable mechanisms; installation of an auxiliary electric motor for silent running; placement of the noisiest parts of a mechanical device (turbine, reduction gear, generators and other mechanisms) on a platform isolated from the pressure hull; automatic balancing of mechanisms in the course of their work; a nuclear reactor with natural coolant circulation; a gravity-flow circulating pump for the main condenser used during silent running; flexible couplings, connectors and inserts by which to isolate propellers and pipelines connecting vibrating mechanisms with the hull; wide use of vibration absorbing materials; foam plastic linings within the hull to reduce air-transmitted noise in compartments.

The noise levels attained in "Ohio" class fleet ballistic missile submarines as a result of introduction of the technological solutions mentioned above are not believed to be the physical limit of what can be attained. Foreign specialists note that the noise level is coming close to values at which the range of sound location becomes comparable with the range of detection of magnetometric resources. An integral level of around 90 dB is believed to be a reasonable limit for reducing the noise level of American nuclear-powered submarines. At this level, detection would involve ranges approximately corresponding to their length (up to 200 m). It is emphasized in the foreign press that by the early 1990s, for practical purposes the threshold of silent running based on the integral level of submarine noise will be attained in "Ohio" class fleet ballistic missile submarines (with regard for the noiseproofing work done on ships in the course of series construction).

Footnote

1. The general indicator of a ship's integral noise is calculated as the total of submarine noise in the acoustic frequency range (from 10 Hz to 10 kHz) at a standard distance R_o (usually 1 yard), and it is measured in decibels (dB). In this case the ratio 20 lg (P/P_o) is calculated, where P is the unknown pressure of the submarine's acoustic noise, and P_o is the unit of measurement of this pressure (usually 1 micropascal). If we assume that $P_o=2x10^{-5}$ Pa and $R_o=50$ m, then when the general indicator of a ship's integral noise is calculated, the difference would be 61 dB.—Editor.

The USA's Military-Space Budget for the 1980s: Dynamics, Structure

18010459k Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 88 (Signed to press 7 Jun 88) pp 61-67

[Article by Cand Econ Sci L. Pankova]

[Text] The goals and objectives of the USA's space program were determined in the first half of the 1980s on the backdrop of important adjustments made in state scientific and technical policy, brought about by the unprecedented rate of growth of allocations for military research and development, and by an orientation on accelerated implementation of the latest scientific and technical accomplishments in weapons and attainment of military superiority over countries of the socialist fraternity. Under these conditions the expansion of the functional capabilities of space-based resources and of their influence upon growth of qualitative characteristics of weapons and military equipment led to a dramatic increase in militarization of the USA's space program.

This is manifested in particular as an increase in the absolute dimensions of allocations for these purposes to the State Department (from $3.8 billion in fiscal year 1980 to $17 billion in fiscal year 1987) and as a high mean annual rate of their growth (27 percent from 1980 to 1987). An increase in the proportion of allocations for the military-space program in the Federal budget (from 0.7 percent in fiscal year 1980 to 1.6 in 1987) and in total outlays on space research by the Federal government (correspondingly from 41.2 to 65.0 percent) is noted concurrently. A tendency for the proportion of outlays on research and design and on purchase of military space equipment can be discerned in the corresponding expenditures of the U.S. Defense Department. The organizational structure of military space activities is improving as well.

The present stage of militarization of the USA's space program is qualitatively unique in that efforts directed at creating space-based weapons—a new form of the resources of armed conflict—are intensifying. Research in the so-called "strategic defense initiative" program (SDI) is especially dangerous. Its goal, according to official assertions by the Reagan administration, is to create a large-scale antimissile system containing space-based components; it is better known in the world as the Star Wars program.

Prior to the beginning of research in the SDI program, development of space-based weapons proceeded under the heading "Space Defense," which embraced the following functional areas: creation of space surveillance and target tracking resources; improvement of the viability of space resources; creation of weapons to destroy space objects by missiles launched from F-15 fighters—the ASAT (Anti-Satellite) program; support to operations conducted under this heading, and development of space- based laser and beam weapons. Up to fiscal year 1984 inclusively, a sum total of over $2.8 billion were allocated to research and design in the in the area of space defense just by the Department of the Air Force and the U.S. Defense Department's agency for long-range development (DARPA). As of fiscal year 1985, part of the work in this sphere, and chiefly scientific research and design of early warning systems, identification of objects in space, space surveillance techniques, and space-based laser and beam weapons (Table 1), was transferred to the administration of the Organization for Implementation of SDI (OISDI).

Table 1. Allocations by the Air Force and the U.S. Defense Department's Agency for Long-Range Development (DARPA) to Scientific Research and Design Work Under the Heading "Space Defense" (in Millions of Dollars)

Allocation Items (Year Financing Began)	Total Allocated up to Fiscal Year 1984 Inclusively	Fiscal Years					Content of Work
		1985	1986	1987	1988	1989 (Requested)	
Air Force							
Antispace defense systems (1974)	972.0	133.0	143.6	169.2	131.9	-	Development of "miniature homing interceptors" under the ASAT program, laser antisatellite weapons, antisatellite systems out of conventional spacecraft, and target satellites
Viability of satellite systems (1973)	126.7	3.3	3.8	1.9	3.3	3.8	Development of technical satellite protection measures
Space surveillance technology* (1971)	230.0	-	-	-	-	-	Development of infrared detectors with mosaic photodetection

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Allocation Items (Year Financing Began)	Total Allocated up to Fiscal Year 1984 Inclusively	Fiscal Years					Content of Work
		1985	1986	1987	1988	1989 (Requested)	
SPACETRACK space surveillance resources (1962-1966; then beginning with 1976)	123.8	10.2	8.5	14.4	9.6	11.0	Improvement of the characteristics of space surveillance resources, including deployment and modification of the corresponding ground-based sensors
Support of operations under the heading "Space Defense" (1981)	28.6	2.9	.	46.1	.	.	Work associated with implementing the ASAT program (tests under this program were started in fiscal year 1982)
Operations control center	177.5	37.4	52.7	39.1	10.0	-	
DARPA							
Strategic equipment* (1962)	819.2	-	-	-	-	-	Development of surveillance, observation, warning and space object identification technology; work on high energy lasers. This direction of scientific research and design was referred to as "Project Defender" between 1962 and 1968.
Experimental evaluation of the basic technical innovations* (1979) including these projects:	321.7	-	-	-	-	-	Development of space-based lasers
—"Talon Gold" (1979)	150.9	-	-	-	-	-	
—"Alpha" (1979)	109.2	-	-	-	-	-	
—"LODE" (1980)	61.6	-	-	-	-	-	

*Financing has been provided since fiscal year 1985 by the OISDI budget.

Around 35 percent of the allocations under the "Space Defense" heading consisted (up to fiscal year 1984 inclusively) of assets for the antispace defense system ($972 million). Special attention was devoted within the framework of this direction to antispace weapons created under the ASAT program. Total outlays on the program up to 1992 were estimated at $3.9 billion, of which $1.35 billion were intended for research, development, testing and evaluation. The first tests of the weapons against a real target in space were carried out in September 1985. As of 30 May 1986 there were 15 experimental two-stage solid-propellant rockets, four "miniature homing interceptors" (Miniature Vehicle) and separate components for another 10 of them, assembly of which is to be completed in stages by November 1988. The research and development stage is to be completed by fiscal year 1988.

Initially, the level of allocations for scientific research and design under the ASAT program initially requested by the U.S. Defense Department for fiscal year 1988 ($402.4 million) twice exceeded the amount allocated to this program by the 1987 budget. This was associated with a review of the plans for antisatellite weapon research in the United States. According to the opinion of official spokesmen of the U.S. Defense Department, research on antisatellite weapons must be concentrated in three directions. The first—attainment of the stage of initial combat readiness of the ASAT system by the early 1990s. The second—improvement of the ASAT system in order to at least double the altitude at which the satellites of a potential enemy would be intercepted (with a possibility for deploying such a system by the mid-1990s). The third—research on and development of a future space-based antisatellite system using excimeric lasers (xenon chloride lasers capable of frequency conversion in the blue-green region of the visible spectrum). To carry out these plans, the U.S. Defense Department intended to get Congress to repeal the prohibition (adopted in fiscal year 1986 and then extended to 1987) on testing the ASAT system against real targets in space. The beginning of the production cycle was planned for 1989 (the U.S. Air Force initially requested $364.5 million for these purposes in fiscal year 1989).

But in reality, rather than $402.4 million, only $131.9 million were allocated to research and design under the ASAT program in fiscal year 1988. Moreover the funding of this program was terminated at the end of 1987. Requests to finance scientific research and design, and

requests for money to begin the production cycle of the ASAT program are generally absent from the updated draft budget submitted to Congress by the Defense Department for fiscal year 1989.

Research in the SDI program promoted significant growth in allocations under the item "Supporting Research and Development" in the U.S. Defense Department's budget for the space program (Table 2).[1] The mean annual rate of growth of allocations for these purposes in the first half of the 1980s (45.1 percent) significantly exceeded the same indicator for other items of the military-space budget. The proportion of assets allocated directly to research under the SDI program in the "Supporting Research and Development" item was 52.5 percent ($734.2 million) of the U.S. Defense Department's budget for the space program in fiscal year 1985. In 1986 as much as $2,675,100,000 were allocated in behalf of the Star Wars program in this item of the Defense Department's expenditures. However, because of growth in allocations in the "Administrative Expenses" item (as a result of formation of space commands in the individual armed services and a joint space command, construction of a joint space operations center and the start of operation of manned reusable spacecraft in the Shuttle program and so on), the increase in allocations in the "Supporting Research and Development" item did not result in an increase in the proportion of scientific research and design work in the USA's military-space budget (on the whole it remained at the level of the early 1980s—around 30 percent).

The modernization of strategic forces occurring in the 1980s is intensifying attention to the development of specific space programs, allocations to which represented 25-30 percent of the USA's military- space budget in the first half of the 1980s. As is evident from Table 3, space systems of basically a supportive nature are undergoing continual improvement, including the DSCS (Defense Satellite Communications System), the navy's FLEETSATCOM satellite communications system, the DMSP (Defense Meteorological Satellite Program), and the DSP (Defense Support Program) ballistic missile early warning system. The new MILSTAR satellite communications system is in the stage of full- scale development, and work on the NAVSTAR global radio navigation system is nearing completion. Improved DSP-2 satellites employing more-sensitive infrared telescopes operating in several regions of the spectrum are more effective in detecting and identifying targets and assessing the results of a nuclear missile strike on the enemy. To increase the viability and interference resistance of DSP-2 satellites, satellite-satellite laser communication line equipment can be installed on them. In the first half of the 1980s over $496 million were allocated to research and design work aimed at improving the DSP system. The prospects for reaching a qualitatively new level of early warning and space surveillance technology are being studied within the framework of SDI under the SATKA program (Surveillance Acquisition Tracking and Kill Assessment).

The MILSTAR system, which consists of eight satellites, five of which are tentatively to be launched into geostationary orbits and three are to be inserted into polar orbits, is being developed in order to ensure dependable communications with wide-band relay stations using a frequency of 10 GHz for transmission and 44 GHz for reception. The satellites of this system are being designed with regard for protection against laser radiation and electromagnetic impulses, and with regard for possibilities for maneuver. There are plans for inserting reserve ("silent") satellites into orbit. The ground resources of the MILSTAR strategic satellite communications system are mobile and intended for rapid redeployment. Allocations for scientific research and design work in this program exceeded $2 billion in the first half of the 1980s. The first stage of the system's deployment is planned for the early 1990s.

Long-range plans called for deploying, in fiscal year 1988, the NAVSTAR global satellite radio navigation system. Its space component will consist of 18 satellites in 6 circular orbits with an altitude of around 20,000 km and with a period of revolution of 12 hours. However, because of the disaster that occurred with the Shuttle reusable manned spacecraft together with its orbiting stage, the "Challenger," serious difficulties arose in launching these satellites. According to present plans of the U.S. Defense Department MLV (Medium Launch Vehicle) launch vehicles of medium cargo capacity will insert three of the satellites into orbit in 1989, and four will be delivered in the cargo bays of the orbiting stages of Shuttle spacecraft. Full deployment of the system was postponed to January 1991.

The NAVSTAR system will have a number of unique characteristics, the principal ones of which are: global coverage, service to an unlimited quantity of users under all weather conditions, determination of the location of users with a precision of 16 m, determination of their speed with a precision of 0.03 m/sec, and determination of time with a precision of up to several microseconds.

IONDS ionizing radiation recording sensors are being installed as added payload in satellites of the NAVSTAR system. These sensors have already been in use in DSP ballistic missile early warning satellites for more than 10 years. There are definite advantages to using these sensors in satellites of the NAVSTAR system—mainly the possibility for surveying a wider span of latitudes, greater sensitivity and lower vulnerability.

The U.S. Defense Department is devoting special attention to development of space transportation resources. The objective is to create a balanced, dependable, flexible system for inserting military payloads into orbit. The Pentagon encountered serious difficulties in inserting military satellites into orbit in connection with the "Challenger" disaster in 1986 and trouble with nonreusable launch vehicles. The need for solving this problem as quickly as possible is also motivated by the research that has been initiated in the Star Wars program.

Table 2. Structure and Dynamics of the U.S. Military-Space Budget

Таблица 2

СТРУКТУРА И ДИНАМИКА ВОЕННО-КОСМИЧЕСКОГО БЮДЖЕТА США

(1) Статья бюджета	(2) Финансовые годы: 1980	1981	1982	1983	1984	1985	1986 (оценка)	(3) Среднегодовые темпы прироста за 1980—1986 финансовые годы, процент
Целевые космические программы (4)	977,3¹ / 25,6	1218,2 / 25,4	1910,8 / 30,0	2070,0² / 31,2	2812,0 / 26,5	3073,0 / 31,0	3201,3 / 20,3	20,8
В том числе в областях: (5)								
навигации (6)	185,6 / 4,8	100,9 / 3,5	234,8 / 3,5	390,0 / 3,4	460,0 / 4,3	561,2 / 4,4	490,6 / 3,1	21,8
связи (7)	506,2 / 13,2	687,6 / 14,3	979,7 / 15,4	1340,0 / 15,7	1408,0 / 13,3	1573,4 / 12,3	1635,1 / 10,3	20,5
раннего предупреждения о запусках баллистических ракет (8)	207,9 / 5,4	283,8 / 5,9	565,3 / 8,9	710,0 / 8,3	758,0 / 7,1	580,6 / 4,5	766,6 / 4,9	20,9
геодезии и картографии (9)	10,3 / 0,3	11,6 / 0,3	28,2 / 0,4	53,1 / 0,6	79,0 / 0,8	63,1 / 0,5	56,2 / 0,4	37,1
метеорологии (10)	67,3 / 1,7	86,5 / 1,8	114,3 / 1,8	230,0 / 2,7	109,1 / 1,0	291,1 / 2,3	291,1 / 1,8	20,3
Разработка космических аппаратов (11)	661,0 / 17,2	750,5 / 15,8	883,8 / 13,8	1070,0 / 12,6	1211,2 / 11,5	1465,0 / 11,3	1661,0 / 10,5	20,3
Обеспечивающие исследования и разработки (12)	427,7 / 11,1	580,1 / 12,2	755,3 / 11,9	920,0 / 10,8	1000,7 / [illegible]	1119,0 / 9,0	2748,2 / 17,4	45,1
Системы контроля и управления (13)	213,3 / 6,2	315,2 / 6,6	433,4 / 6,8	610,0 / 7,1	[illegible] / 7,[illegible]	1123,2 / 8,8	1211,3 / 7,8	30,7
Административные расходы (14)	1510,1 / 40,0	1919,1 / 40,0	2389,0 / 37,7	3270,0 / 38,1	4657,7 / 44,0	6061,7 / 46,8	6880,6 / 44,1	35,3
Всего (15)	3818,1 / 100,0	4797,1 / 100,0	6342,3 / 100,0	8510,0 / 100,0	10590,1 / 100,0	12913,0 / 100,0	15616,0 / 100,0	22,7

(16) ¹ В числителе указаны ассигнования по данной статье бюджета в миллионах долларов, а в знаменателе — доля в процентах к общим ассигнованиям за год.

(17) ² Данные за этот год по целевым космическим программам в отдельности при сложении не соответствуют общей сумме, так как часть средств (46,9 млн. долларов) была выделена на исследования в областях, которые не указаны в таблице.

Key:
1. Budget item
2. Fiscal year
3. Mean annual growth rate in fiscal years 1980-1986, percent
4. Specific space programs
5. Including in the areas of
6. Navigation
7. Communications
8. Early warning of ballistic missile launchings
9. Geodesics and cartography
10. Meteorology
11. Development of spacecraft
12. Supporting research and development
13. Monitoring and control systems
14. Administrative expenses
15. Total
16. The numerator indicates allocations for the given budget item in millions of dollars, the denominator shows the percentage of total allocations for the year.
17. Figures for this year for the individual specific space programs do not add up to the total sum, since part of the assets ($46.9 million) were allocated for research in areas not indicated in the table.

Table 3. Allocations to Specific Space Programs of the U.S. Department of Defense (in Millions of Dollars)

Таблица 3

АССИГНОВАНИЯ НА ЦЕЛЕВЫЕ КОСМИЧЕСКИЕ ПРОГРАММЫ МИНИСТЕРСТВА ОБОРОНЫ США
(в млн. долларов)

Программа (1)	Финансовые годы (2)									
	1980	1981	1982	1983	1984	1985	1986	1987	1988 (запрос) (3)	1989 (запрос)
Сухопутные войска (4)										
Глобальная радионавигационная система НАВСТАР (5)	19.5*/—	10.0/—	21.0/—	11.2/—	5.8/—	13.5/—	11.3/0.7	7.5/10.3	—/—	—/—
ВВС (6)										
Системы связи (7)										
DSCS	21.0/10.0	33.3/63.0	60.0/132.0	51.0/101.0	34.9/111.7	31.0/250.4	7.1/190.2	10.8/123.0	31.4/75.0	53.6/21.1
МИЛСТАР (8)	—/—	25.0/—	78.0/—	100.8/—	330.0/—	453.3/—	446.5/—	743.3/72.0	229.2/—	310.4/—
Метеорологическая система DMSP (9)	17.0/29.1	19.0/60.0	45.5/30.0	25.4/170.0	23.0/31.1	42.0/190.1	51.3/41.0	82.1/60.1	30.2/153.0	68.5/200.0
Глобальная радионавигационная система НАВСТАР (5)	133.3/—	120.2/—	105.1/20.1	122.7/101.5	129.0/250.1	107.5/—	70.0/—	60.3/—	72.1/110.0	123.0/122.5
Система раннего предупреждения о запусках баллистических ракет DSP (10)	31.0/—	87.0/—	145.7/—	121.6/—	40.7/—	63.0/—	65.0/117.0	113.0/97.7	103.6/—	95.2/—
ВМС (11)										
Системы связи (7)										
ФЛИТСАТКОМ (12)	17.0/20.1	5.1/30.0	30.0/84.0	5.5/249.3	9.2/101.5	11.0/51.1	13.2/50.3	—/72.0	—/222.8	—/235.5
МИЛСТАР (8)	—/—	—/—	—/—	—/—	—/—	—/—	3.0/—	4.0/—	4.8/—	4.0/—
Глобальная радионавигационная система НАВСТАР (5)	10.1/—	17.3/—	31.0/—	30.0/—	65.4/—	63.1/—	50.2/24.0	64.7/17.2	79.0/—	75.0/—
Метеорологическая система DMSP (9)	—/—	1.0/—	0.8/3.0	0.8/—	0.8/—	21.4/—	30.1/8.8	12.5/9.0	4.1/—	3.3/—

(13) * Здесь и далее в числителе даны ассигнования на НИОКР, а в знаменателе — на закупки.

Key:
1. Program
2. Fiscal year
3. Requested
4. Ground troops
5. NAVSTAR global radio navigation system
6. Air force
7. Communications systems
8. MILSTAR
9. DMSP meteorological system
10. DSP ballistic missile early warning system
11. Navy
12. FLEETSATCOM
13. Here and subsequently allocations for scientific research and design work are given in the numerator, and procurement allocations are given in the denominator.

According to predictions of the OISDI, over 26,000 tons of payload will have to be inserted into orbit over a 23-year period (beginning in 1995).[2] The tentative cost of these operations is from $87 billion to $174 billion. They will require around 75 Shuttle flights per year,[3] which will make it necessary to reduce the time allocated between flights for repairs and restoration from 53 to 10-14 days, and to increase the throughput of the launch complexes.

According to preliminary estimates more than 160 types of conceived payloads could not be inserted into orbit in the cargo bays of Shuttle spacecraft owing to their great size and weight. Their design length attains 60 m, diameter attains 15 m and weight attains 180 tons, while the length of the cargo bay of the Shuttle's orbiting stage is 18.3 m, its diameter is 4.58 m, and the maximum weight of a payload launched into near-earth orbits with an inclination of 28° (the geographical attitude of the launch complex at the Kennedy Space Center, Cape Canaveral) is 29.5 tons. The need arose for developing space transportation resources of greater cargo capacity, and for increasing the possibilities for moving payloads into high orbits, including geostationary ones, by means of interorbital space tugs.

The USA is currently evaluating the reasonable cargo capacity of future cargo spacecraft, and it is studying and developing an unmanned heavy launch vehicle based on elements of the Shuttle spacecraft (ALS—Advanced Launch System).

The following figures show that the U.S. Defense Department is actively pursuing work on space transportation resources. In addition to its budget for fiscal year 1987, the Pentagon requested $110 million for the development of heavy launch vehicles capable of inserting payloads of 45 to 68 tons into low orbits. The total initially requested assets for scientific research and design work concerned with development of space transportation systems by the air force and the OISDI for fiscal years 1988 and 1989 were $767.0 million and $778.1 million, which is almost twice more than the corresponding allocations in fiscal year 1987. In January 1988 President Reagan gave his approval to a program for creating heavy launch vehicles capable of carrying payloads of 45-90 tons into low near-earth orbits by the late 1990s.

Thus a significant proportion of the financial resources allocated to the USA's military-space programs in the 1980s were used for development and improvement of satellite systems intended to support the activities of the armed forces (navigation, communications, meteorological, ballistic missile early warning, global reconnaissance and so on), and resources for delivering military payloads into near-earth orbits, including the manned reusable Shuttle spacecraft. The stages of development of a number of the Pentagon's major space projects, particularly NAVSTAR, MILSTAR and others, should be completed in the late 1980s and early 1990s. Efforts to create an antispace defense system under the ASAT program have been halted.

For the moment the work going on under the Star Wars program, which was officially initiated in 1985, is limited to fundamental theoretical research accumulating the latest accomplishments in various areas of science and technology, and no one can predict the specific results of this work with sufficient reliability. In fiscal year 1987 the total allocations to SDI were $3,650,300,000, of which $3,290,000,000 were reserved for the Defense Department and $360.3 million were reserved for the Department of Energy. Practically all of these assets were earmarked for scientific research and design work, with only $10.3 million being allocated for construction (in the Defense Department). It is anticipated that the total allocations for the SDI program in fiscal year 1989, the draft military budget of which is presently being discussed in Congress, will be around $4.5 billion.

Footnotes

1. This military-space budget does not include allocations for reconnaissance satellites chiefly in connection with the high secrecy surrounding such projects.

2. According to some data the maximum value of this indicator will be 90,000 tons.

3. A total of 30 Shuttle flights are planned in the next 3 years (1988- 1990).

NATO Infrastructure in European Theaters of Military Operations

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[Article by Col V. Elin and Col (Res) Yu. Korolev, candidate of military sciences]

[Text] In their aspirations for world domination, the most reactionary imperialist circles of the West are putting their stakes on power, and they are preparing for new wars. One of the important directions of such preparations by the NATO bloc is creation and development of the military infrastructure.

The term "military infrastructure" is defined abroad as the system of a country's (region's, theater of military operations') permanent installations intended for support, accommodation, training, deployment and combat (military) activities of troops. This system includes the stations of military units (formations), institutions and military schools, control posts, airfields, missile and

naval bases, communications installations, test ranges and training fields, depots, pipelines, highways and railroads, and it includes engineer organization of the ground (fortification of obstacles, defense lines and other lines and areas, installation of obstacles, preparation of crossings, extraction of water and so on).

The NATO command also includes within the infrastructure some nonpermanent installations which "may satisfy the basic requirements imposed on permanent installations of the infrastructure"—for example mobile control posts (Figure 1 [figures not reproduced]), communications installations and others. However, the total outlays on nonpermanent installations represent only a small share of the bloc's total expenditures for these purposes.

The Western countries began forming the unified military infrastructure prior to NATO's creation. In 1948, in accordance with the Brussels Treaty five states—Belgium, Great Britain, Luxembourg, the Netherlands, France—established the Western Alliance (reorganized into the Western European Alliance in accordance with the 1954 Paris treaties). This treaty foresaw in particular improvement of the most important existing military installations for their subsequent joint operation, and development of unified requirements on new installations of the infrastructure. A general work program was instituted, with the cost being distributed among the countries that signed the Brussels Treaty; in this case Great Britain and France absorbed over half of the expenses (around 32 million pounds Sterling).

With formation of the North Atlantic Treaty Organization in 1949, the fundamental principals for the activities of the former organization in regard to creation of the infrastructure not only were preserved but also developed further. The NATO infrastructure program, or as it is sometimes called, the program for development of the bloc's infrastructure, was adopted in 1951. It is a list of specific approved projects (with the allocated funds indicated). A total of 500 such projects are carried out each year in various aspects.

In order to carry out mutual financial operations between countries and NATO organs, NATO adopted the Infrastructure Account Unit (IAU).

Periodically, usually once every half year, it is adjusted depending on money market. For example in 1987 one IAU was equal to approximately 2.07 English pounds Sterling, or 3.12 American dollars, or 6.97 West German marks.

The first infrastructure programs were planned for a year. Long-range plans covering several years (5 as a rule) began to be written in 1954. Today the present program was adopted for 6 years (1985-1990). Military preparations financed and implemented within the framework of infrastructure programs are subdivided in NATO into so-called infrastructure categories. All projects are placed in 1 of 13 normal categories and in the special projects category.

The most important categories are reflected in annual programs, while the others may be included in them at intervals of several years depending on need. Projects adopted in view of their significance and timeliness without observing the established procedure, as an exception, are placed in the special category.

The normal categories of the infrastructure include: airfields, naval bases, pipelines and POL dumps, communications installations, air force and naval navigation support installations, air and sea space monitoring and warning installations, troop control posts (permanent and mobile), training centers and training grounds, missile bases for missiles of various classes (two categories), nuclear ammunition dumps, forward depots for weapons, military equipment and materiel, and installations supporting the stationing and deployment of reinforcing units and formations (reception points, depots, crossings).

The financing of the projects and distribution of expenditures among the bloc's countries have great significance to implementation of plans having to do with the infrastructure. As with other international organizations, NATO organizes its activities on the basis of formation and use of centralized money funds, the most important of which are the budget of the central organs and the special fund for the infrastructure development program.

However, the bulk of the money used to finance military preparations in NATO is allocated by individual states to their own national programs, but the dimensions of specific funds created within the bloc itself are also quite sizable. Thus the NATO budget for erection of installations of the military infrastructure, paid for by assets provided by member countries, was $13.6 billion in the period from 1950 to 1985; in this case more than half of this sum was spent in 1980-1985. Over $7.8 billion were allocated for implementation of the present six-year program.

The share allocated by a country to finance the programs and projects is determined annually as a rule, and it depends on political and economic factors. For example, the latter account for gross national product, the amount of compensation that may be enjoyed from operating installations of the infrastructure within the country's territory, the advantages of developing the transportation net, and so on. Using the bloc mechanism, the USA always strives to tie down its partners with long-term obligations, and to transfer part of the burden of the expenditures to their shoulders. The share the United States pays to cover the expenses of the infrastructure decreased significantly in comparison with the first years of the bloc's existence, but it still remains high—from 25

to 28 percent. The FRG contributes almost the same amount. The role of other countries, according to data for 1987, is characterized by the following figures (percent contributions): Great Britain—12, Italy—8, Canada—6.5, the Netherlands—5.2, Belgium—4.6, Denmark—3.8, Norway, 3.2 etc.

As far as the absolute values of expenditures are concerned, they can be illustrated by facts taken from the foreign military press. Prior to 1975 approximately $300 million were allocated from NATO funds each year for the infrastructure on the average. In the present six-year program four times more money is to be spent each year—that is, around $1.3 billion.

The bloc's military leadership determines the basic directions of development of its infrastructure. The supreme high commands of the joint forces and the main commands of the NATO joint forces prepare proposals justifying the need for construction of particular installations. The requirements which the installations must satisfy are determined specifically by the staffs, and the proposals are sent to the countries in which they are to be implemented. In this stage the priority of the projects and the timetable of their fulfillment are tentatively determined. The finalized projects are returned to the supreme high command of the NATO joint forces. There the summary draft program for the year is drawn up and then submitted to the defense ministries of the member countries.

The draft program is then submitted, with regard for the proposals of the latter, to a military committee for evaluation of the operational side of the projects, and to the NATO Infrastructure Committee to resolve technical and financial problems. The program is finally approved (this is actually just a formal procedure) by the bloc's supreme military-political organ—the Military Planning Committee. From this time on the program is assumed to have been adopted, and the countries in which the projects are to be implemented are responsible for their fulfillment; in some cases this responsibility is borne by the bloc's agencies and organs.

Overall leadership of the financial, economic, engineering and technical aspects of the infrastructure's development is provided by one of the assistants to NATO's secretary general, who also deals with the problems of rear support and preparation of the civilian sector of the economy for war. The controller for infrastructure, who is the chairman of the NATO Infrastructure Committee, is subordinated to him. The functions of this organ include determining the methods of attaining goals, promoting practical implementation of the bloc command's plans for organizing theaters of military operations and the territory of member countries, and accepting finished installations.

The deputy controller for infrastructure heads the Payments and Progress Committee. This committee directly determines the financing to be provided to projects, monitors their fulfillment, and calculates the general expenditures on the programs and the contributions of the individual countries.

In different periods, certain directions of the infrastructure's development receive more attention; in this case 90 percent of all work was done within the zone of responsibility of the supreme high command of NATO joint forces in Europe. Prior to 1957 the funds were channeled chiefly into building airfields, installing communication resources in theaters of military operations, laying pipelines and creating POL dumps, setting up naval bases, building radar centers and posts, and installing underground command posts. When the bloc's troops began receiving nuclear weapons, creation of missile bases and nuclear ammunition storage dumps received priority. Installations for the control of resources of NADGE, NATO's joint air defense system in Europe (Figure 2), assumed a special place in the early 1960s. Construction of launch pads, nuclear ammunition depots and airfields continued concurrently. Subsequent plans foresaw development and improvement of existing installations and construction of new ones for cruise missiles and Pershing missiles, improvement of the viability and defenses of installations, and implementation of preparatory measures for the creation of obstacles and obstructions.

Preparation of a theater of military operations in behalf of the armed forces basically entails creating an echeloned system of missile and air bases, airfields, naval bases and ports, communication and transportation routes, permanent control posts and air defense installations, communication lines and centers, obstacles, fortifications and military depots. Logistic support and protection of troops, the civilian public and rear service installations from mass destruction weapons play an important role.

Fulfillment of the programs of NATO's infrastructure in Western Europe has resulted in erection of 220 large, well equipped airfields, and according to the foreign press, there are now over 1,500 airfields of different classes and landing pads in NATO European countries. To increase the viability of aviation, around 4,300 shelters have been built at almost 200 airfields. Of these, more than 3,000 are reinforced (reinforced concrete arched shelters, Figure 3), and most of the individual parking pads are revetted.

There are plans for erecting around another 660 airplane shelters at air bases using assets from the infrastructure development fund. This work is to be completed in the mid-1990s.

In countries included in the Central European theater of military operations, in recent years the landing strips have been repaved, the width of the main taxiways has been increased, airplane parking pads are being widened, and the capacity of storage facilities is being increased. Special pit or partially underground shelters are being

erected to protect communication resources and storage depots, and pit shelters up to 5 m deep with their slopes lined with reinforced concrete slabs and permitting through traffic are being erected for tanker trucks and other special vehicles. Reserves of ammunition, fuel and spare parts for American tactical air subunits are being created on the territory of European NATO countries.

In Italy and Greece, airfield reconstruction foresees lengthening and reinforcing the landing strips and installing more contemporary navigation equipment. Prefabricated shelters are being set up for flight crews and technical personnel in direct proximity to airplane parking pads, and there are covered slit trenches accommodating from three to seven persons next to each airplane parking pad.

The USA has been working for a number of years on the so-called "conception of unprepared airfields," in accordance with which air force combat units and support subunits are transferred in response to a combat alert to airfields not utilized in peacetime but possessing landing strips, taxiways, parking pads, and electric power and water sources. Sets of mobile navigation equipment transferred from main air bases are to be set up there as well.

Airfields which would require slight lengthening or reinforcement of the landing strip and selected motor road sections or specially built sections (on new freeways) with characteristics satisfying the requirements imposed on landing strips can also be used as alternate airfields. Wide use of such sections is planned in the FRG and other countries.

Judging from reports in the Western press, after the war in Indochina and the 1973 Arab-Israeli War, the USA and NATO came to the conclusion that land-based defense of airfields, and chiefly of forward air bases and airfields occupied temporarily, needs to be reinforced. For this purpose they began extensively introducing various security systems utilizing electron-optic devices.

Around 50 naval bases and more than 40 forward bases have been created for the navies of the bloc's countries in the European theater of war. Underground shelters have been dug into rock at some naval bases (for example in Khokonsvern and Olavsvern [transliterations], in Norway, in Khors-fjord [transliteration] in Sweden, and at the forward base in Bartin, Turkey); reinforced concrete underground shelters have been built for ships and submarines (Brest, Lorient and La Pallis [transliteration] in France; Bergen, Norway and others); accommodations for command posts, communication centers, fuel and ammunition dumps, electric power plants, workshops and personnel have been built as well. The foreign press indicates that there are now around 30 shelters of different types in Western Europe capable of accommodating over 120 submarines, surface ships and launches, and providing for their docking, repair and technical service.

Communications facilities financed by joint infrastructure programs include ground, underground and submarine cable communication lines, communication centers and radio relay and satellite communication systems making up the global communication network of the NATO joint forces. Around $1.5 billion were spent on their creation from 1951 to 1980. Some of these facilities are serviced by military subunits in the joint forces, while the countries in which the facilities are located are responsible for operating the others.

Installations of NATO's NADGE joint air defense system are located in nine European bloc countries, and they include radar stations, control and data transmission equipment and computers. Their creation cost $320 million.

In the period from 1950 to 1958 fortifications of the Maginot Line were modernized with the purpose of raising the protection they offered against mass destruction weapons; in addition, measures were implemented to mothball permanent weapon emplacements. Many installations were converted into supply depots and for other uses in behalf of the rear. In recent years, certain fortifications have been subjected to restoration only in the Metz and Lauter fortified areas.

NATO military specialists are devoting considerable attention to creating conditions for deployment of combat units and for reception of reinforcing units and subunits, and to the problems of material and technical support to troops in the event of war, including distribution and dependable storage of various stockpiles. The FRG is conducting intensive construction of military supply depots. Just within the Central European theater of military operations their total number exceeds 1,500. In accordance with the POMKUS [transliteration] program (for prepositioning of sets of weapons and military equipment), the command of the U.S. Armed Forces plans to have reserves of armament for six ground troop divisions and logistic support resources for 10 divisions at depots (Figure 4) located in European NATO countries; in addition these depots are to store armament and logistic support resources for a Marine expeditionary brigade and the logistic support resources necessary for quickly raising the effective combat strength of the air force. The storage sites for armament sets to be provided to ground divisions were erected in accordance with the bloc's infrastructure development program, and they were placed into operation in 1985. Heavy military equipment (tanks, armored personnel carriers, trucks) have already been stockpiled in them. Construction of storage sites in rock in central Norway and creation of the corresponding reserves in them were initiated in 1985 for the Marine expeditionary brigade. All of the work is to be completed by late 1989.

Lines of communication are an important component of the infrastructure. The NATO command believes that without sufficiently developed and specially prepared

lines of communication, it would be difficult to mobilize, concentrate and deploy troops, and to regroup resources in a theater of military operations.

A rather widely branched system of railroads has been created in Western Europe. For example their average total length in the Central European theater of military operations is over 8 km per 100 km^2. Foreign specialists note that the tracks are in good technical condition. There are several routes extending both latitudinally and longitudinally within the bounds of this theater of military operations.

Many manmade structures have been built along the railroads—especially tunnels (there are around 650 in the FRG, 1,500 in France, 1,900 in Italy, 80 in Belgium, 720 in Norway and 700 in Turkey). In the opinion of NATO military experts the role of tunnels has recently increased significantly. They can be used extensively as shelters to protect servicemen, the civilian public and materiel from mass destruction weapons. At the same time, their incapacitation and destruction would delay movements of troops, combat equipment and materiel.

The NATO countries also possess a widely branched network of high quality motor highways, making it possible to select frontal and lateral routes in any direction. In about the last 15 years a significant amount of work was done there to improve transportation links. All major administrative and industrial centers are linked together by high- speed freeways, which may be used in wartime to transfer troops and deliver various military cargo. Development and improvement of lines of communication in the interests of NATO are proceeding in the direction of raising the throughput and traffic capacity of roads, widely introducing containerized shipments, building high-speed freeways and straightening certain road sections. The traffic capacity of high-speed freeways exceeds 20,000-30,000 motor vehicles per day.

Inland waterways of the Central European theater of military operations are typified by a dense network of navigable rivers and canals making up a single water system that is closely linked to marine lines of communication. Their overall length attains 20,000 km, of which over half is represented by canals.

It is indicated in foreign publications that in wartime, river transport will enjoy rather wide use within the zone of communications, where it may assume part of the shipment burden, especially in the interests of the rear and in conjunction with deliveries of large lots of cargo and containers. In the event that permanent bridges are destroyed, it may become the river fleet's task to ensure continuity of military shipments by utilizing vessels as ferries. In this connection moorings and piers are being built and reconstructed, port facilities are being equipped with more-productive freight handling machinery, rivers and canals are being deepened, and navigation conditions and navigation equipment are being improved in countries such as the FRG, Belgium and the Netherlands. Some of this work is financed by common funds allocated to the infrastructure.

However, there are some shortcomings associated with inland waterway transportation in behalf of armed forces—particularly the low speed of vessels. Moreover foreign military specialists feel that locks, bridges, tunnels and other structures are vulnerable places, and they feel that were they to be incapacitated, movement of vessels would be completely disrupted over a long distance.

In the overall system of measures to develop NATO's infrastructure, great significance is attached to creating a branched network of military and civilian pipelines—the most sensible means of providing petroleum products to armed forces. The decision to create permanent pipelines was adopted by NATO in 1952, and construction of installations to support troops with petroleum products was basically completed in 1968. Since then, in connection with growth of the population and the increase in equipment availability to armed forces of bloc countries, the demand of the troops for POL has been increasing. This is why the entire system of supplying this form of materiel has been undergoing continual improvement. As far as pipelines are concerned, the pipe diameter has been increased to 338 mm and second and third parallel strings have been laid in sections leading from fuel unloading points.

The total length of the network of military pipelines built under the NATO infrastructure program is around 11,000 km, and the total capacity of storage facilities and supply depots is 2.4 million m^3, which is enough to supply fuel to the rear areas of army corps and almost 100 airfields. Judging from foreign publications the existing systems of military and civilian pipelines, petroleum product unloading ports and oil refineries are capable of providing fuel to NATO ground troops and air forces in the first months of a war.

Use of obstacles is one of the important factors influencing the course of combat activities. NATO specialists feel that some obstacles may be realistically prepared while still in peacetime, while others can only be planned—that is, they can be included in the plan for preparations, and they may be located on maps and at specific points on the ground.

This is why serious attention has been and continues to be devoted to creating obstacles and zones of destruction and flooding when examining the problems of engineer organization of the ground. Blasting chambers (holes) are prepared for this purpose in bridge and track supports and spans, at road junctions, in narrow defiles, on mountain passes, in tunnels, in certain of the most important rail and highway sections, at the pumping stations of NATO's main pipelines, on landing strips, at permanent communication facilities and in other places. Obstacles may be created with ordinary land mines. It is

recommended that the latter be used to create areas impassable to the troops in narrow canyons, and slides in valleys, on mountain passes and across rivers, to knock out highways and airfields and to block tunnels. The army command of the NATO countries is devoting considerable attention to the ability of the troops to quickly and effectively destroy lines of communication along which enemy movement is anticipated. It is believed that together with destruction of lines of communication, minefields will make it possible to create vast zones of hard-to-cross ground, and because the enemy would concentrate before obstacles, the effectiveness of artillery and air strikes would be higher.

There are plans for setting up obstacles in certain areas of ground taking the form of large craters formed by exploding nuclear mines or powerful charges of conventional high explosives. So-called mine chambers 4-6 m deep and 60 cm in diameter are created for this purpose in peacetime. Thus there are over 9,000 of them in the FRG. Centers of destruction are to be created mainly along borders with East Germany and Czechoslovakia. In addition the NATO military leadership foresees selective use of nuclear mines with the purpose of creating zones of destruction, obstacles and areas of radioactive contamination in the course of "limited" nuclear war. The principal objectives of destruction by nuclear mines would be large bridges, dikes and dams.

Each year the NATO armies carry out special exercises for engineer units in order to improve the methods of knocking out bridges and other installations (Figure 5). During them, the techniques and methods of quickly destroying existing permanent structures of various types by special resources are practiced. The American press reported on experiments to destroy bridges by means of explosions produced in the water, beneath the spans. In this case there are suggestions for using not only conventional high explosive charges but also nuclear mines in some instances.

NATO military specialists feel that favorable possibilities for conducting defensive combat at water obstacles could be created by various means. In particular there are plans for setting up obstacles in the water and on the banks, to pour flammable liquid (petroleum- based) on the water surface and ignite it at the needed moment, and to artificially change a waterway's flow conditions—that is, to create water obstacles. Petroleum products can be used to set up fire-and- water obstacles at important water lines. They can be stored in supply depots and at refineries located near water basins as a rule. Nor is the possibility for accumulating reserves of fuel and equipment specially for this purpose excluded.

According to calculations by foreign specialists, were the gates of manmade water discharge installations to be opened, the extent of the flooding would not exceed that occurring with natural floods. Although this alone could significantly reinforce the blocking properties of rivers, this is not felt to be enough in NATO military circles. Therefore there are plans for demolishing dams in order to attain large-scale flooding.

The foreign press has carried information indicating that in the FRG, mine chambers have been created in 25 large dams and in the steep rocky banks of the Rhine, Weser, Ruhr, Lahn and other rivers. It was also noted that zones of flooding are to be created not only in front of the enemy's advancing troops but also in his rear by demolishing the principal hydraulic engineering structures using radio-controlled mines, as well as bombs and rockets.

Because these measures require considerable outlays of effort and time, a significant part of this work is to be carried out while still in peacetime. A permanent working commission is working under NATO to develop unified tactics for using mines and antimine weapons, including to reinforce obstacles at water crossings.

Besides fulfilling joint programs for development of the NATO infrastructure, the bloc countries are building various military installations on the basis of assets from the budgets of the defense ministries and other departments of the countries themselves. West Germany is an example. Its outlays on the NATO infrastructure were approximately 610 million marks in 1987, while total expenditures on military construction in behalf of the Bundeswehr were almost three times greater.

Engineer troop subunits are used to carry out both multilateral and national projects. Officers with qualifications as builders help to develop the requirements on permanent installations of the civilian infrastructure—for example roads, bridges etc. They take part in designing facilities, and they monitor compliance with the interests and requirements of military departments in the course of construction.

The programs for development of the North Atlantic alliance's infrastructure and the continual growth of expenditures on these programs attest to continuation of NATO's militaristic preparations, which evoke the valid concern of progressive society in all the world. The feeling of deep satisfaction with which the Soviet people welcome the peace-loving initiatives of the Communist Party and the Soviet government is understandable in this connection.

Submarine Minelaying Device

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[Article by Capt 2d Rank V. Mosalev]

[Text] The FRG has created a special MWA-09 device that is mounted on the navy's submarines to transport and lay submerged mines (up to 24 mines with a maximum length of 3.1 m each and a diameter of 0.54 m). It

was developed by the IKL (Ingenieur Kontor Lubeck) design office and manufactured by Abeking und Rasmussen [transliteration] at the ship building dock in Lemwerder.

The device consists of two streamlined pods (each accommodating 12 mines of different types; their dimensions are 11.45x1.55x3.6 m, and their weight is 5 tons), manufactured out of glass-reinforced plastic and low-magnetic steel. They are suspended on the sides at the bow of the submarine, behind the sonar fairing, and secured to the hull from the bottom by steel rubberized cables and from the top by slip hooks. The pods possess negligible positive buoyancy (owing to presence of a solid foam plastic filler), and they are designed to work at a submarines's diving depth. If need be, a submarine can jettison them while submerged; in this case they are designed to take in water so as to acquire negative buoyancy, and then sink, thus keeping the submarine from being spotted. Mines can be laid at a speed of up to 12 knots.

The MWA-09 device is stored ashore, and it is filled with mines prior to use. Then it is lowered into the water by means of a crane (see figure [not reproduced]) and towed to the mooring of a submarine making ready to conduct a minelaying operation. The submarine's personnel position the pods on the sides at the submarines's bow and secure them to the hull manually (without using any hoisting mechanisms). When the submarine returns to base after carrying out its mission, the pods are removed and towed to the storage site, where they are inspected and, when necessary, prepared for reuse.

It is noted in the foreign press that use of the MWA-09 device worsens the sailing qualities and stability of the submarine and raises its noise level only negligibly. In particular the maximum submerged speed of a submarine decreases by not more than 1.5 knots. The developers and manufacturers assert that considering data from sea trials and the experience of operating the MWA-09 device in the West German navy, several modifications for submarines of different types may be designed quickly. The naval commands of a number of the world's countries have shown an interest in this device.

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